Regulatory Competition and the Politics of Environmental Enforcement

By

David M. Konisky

M.E.M., Yale University (1998)
M.A. International Relations, Yale University (1998)
A.B. History; Environmental Studies, Washington University (1995)

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Signature of Author: _____
Department of Political Science
May 16, 2006

Certified by: _____
Stephen M. Meyer
Professor of Political Science
Thesis Supervisor

Accepted by: _____
Roger D. Petersen
Associate Professor of Political Science
Chairman, Graduate Program Committee

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Abstract

Does interstate economic competition result in states weakening their environmental regulation? Scholars have long been interested in this question. Of particular concern, is whether this type of behavior leads to a "race to the bottom" in U.S. state environmental regulatory behavior. Although there is a mature theoretical literature investigating the conditions under which regulators will use environmental measures as competitive instruments vis-à-vis other states for attracting economic investment, the empirical literature has lagged far behind in testing the direct predictions of the race to the bottom argument. The purpose of this project is test the applicability of the race to the bottom argument in U.S. state environmental regulation.

To test the race to the bottom argument, I examine both behavioral and attitudinal evidence. Specifically, I estimate a series of strategic interaction models which aim to detect whether state enforcement of three federal pollution control programs – the Clean Air Act, the Clean Water Act, and the Resource Conservation and Recovery Act – follows a pattern consistent with regulatory competition theory generally, and the race to the bottom argument specifically. I also conduct a nationwide survey of senior officials working in state environmental agencies. This elite level survey helps to validate the behavioral evidence studied in the statistical analysis, as well as elucidates the mechanisms of regulatory competition within states.

My research finds strong evidence that state environmental regulatory behavior is interdependent – that is, state regulatory agencies respond to the regulatory behavior of the states with which they compete for economic investment. Evidence from both the statistical analysis of state enforcement data and the survey of state environmental regulators supports this conclusion. The evidence for a race to the bottom is less clear. While I do find that some states weaken their environmental regulatory effort in response to interstate economic competition, I also find that other states strengthen their regulatory effort, which supports an alternative race to the top argument. In the final part of the dissertation, I reconcile these results by identifying the factors that make particular states more susceptible to race to the bottom-type behavior.

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Title: Professor of Political Science

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Chapter 1. Introduction

Introduction

Should the authority to set environmental regulations and enforcement levels rest with national or state governments? This question has been at the center of a long-standing debate about the institutional design of U.S. environmental policy. Of course, this issue is not unique to environmental policy. Questions about the balance of power between the federal and state governments are central to contemporary public policy debates in areas ranging from taxation to welfare to education. These debates are also not unique to the United States. Other federal systems, such as Canada (Harrison, 1996a) and Germany (Rose-Ackerman, 1995), struggle with the same issue, as do multinational government arrangements such as the European Union (Esty and Geradin, 2001).

This debate involves many issues including transboundary pollution spillovers and the comparative capacity of national and subnational governments to regulate the private sector. One of the most prominent questions regards whether decentralized environmental policy-making will result in a "race to the bottom" in environmental regulation. In the U.S. context, critics of decentralization argue that states are primarily concerned with economic development, and, when faced with interstate competition for economic investment, they will relax their environmental regulation to gain an advantage over other states. That is, states will engage in regulatory competition through the strategic choice of their environmental regulatory effort vis-à-vis their economic competitors. If all states behave similarly, the logical end is a debilitating race to the bottom in environmental protection, with a convergence of regulatory standards and enforcement efforts at the level of the state with the least stringent regulation. Some argue that centralization of environmental protection responsibility with the federal government in general, and setting uniform, national standards in particular, is necessary to prevent this outcome (Cumberland, 1979; Stewart, 1977).

By contrast, proponents of decentralization argue that interstate economic competition among states will lead to socially-optimal environmental regulation (Revesz, 1992; 1997). While there will be variation among state regulatory decisions, each state will manage the

tradeoff between economic development and environmental protection in a manner that corresponds to the preferences of its citizens. Moreover, decentralization advocates argue that a transfer of responsibility to state governments will lead to policy innovation and democratically more legitimate outcomes, since regulators will be able to tailor local policy responses to match local preferences (Dye, 1990; Peterson, 1995).

There is now an enormous academic literature, crossing several disciplines (e.g., economics, law, political science), that considers the theoretical case for environmental regulatory competition. The theoretical literature leaves some questions unanswered, but the more significant gap is empirical. Empirical investigation has lagged far behind in testing many of the central predictions suggested by regulatory competition models. In particular, scholars have not sufficiently tested whether regulatory competition – if, in fact, it does exist – results in states weakening their environmental protection efforts in a manner consistent with the race to the bottom argument.

Whether or not regulatory competition results in a race to the bottom in state environmental protection efforts is a salient question for several reasons. In addition to the decades of debate in the academic literature, several trends suggest its continuing (if not, increasing) importance as a public policy matter. First, there is a widespread belief that environmental regulations influence business investment decisions (Engel, 1997; Jaffe, et al., 1995); public discourse is replete with statements about the purported effects of environmental regulation on state competitiveness. Second, competition among the states for new economic development is intense (Greenstone and Moretti, 2004; Bartik, 1991), and, as the U.S. economy becomes more service-based and manufacturing jobs continue moving abroad, competition for a diminishing stock of mobile capital may become more severe.

Additionally, political trends suggest a potentially growing role for states in environmental protection. There is a strong, often nonpartisan, push to devolve federal government responsibilities to the states (Donahue, 1997), a movement that is particularly strong in the area of environmental protection (Engel and Rose-Ackerman, 2001). A rethinking of federalism is also underway in the judicial arena. The Rehnquist Supreme Court made a concerted effort to restrict the power of the national government and to increase the autonomy of the

states (Melnick and O'Neil, 2003). In sum, concerns about state competitiveness, intensifying competition for new business investment, and political pressure for decentralization indicate a need to better understand the factors explaining state environmental commitment and whether interstate economic competition influence state regulatory practices.

My primary objective in this dissertation is to address the gap between the theoretical and the empirical literature. I first examine the question of whether state governments actually behave in a way consistent with the race to the bottom argument – that is, whether state environmental regulatory behavior fits a pattern reflective of the race to the bottom argument. Second, I consider whether we observe a convergence of environmental regulatory effort at the level of the least stringent state. I then whether there is strategic interaction in U.S. state regulatory behavior – that is, whether states respond to the regulatory behavior of states with which they compete for economic investment. Subsequently, I dissect the theoretical case for a race to the bottom in environmental regulation, by considering various asymmetric relationships between states. The logic of the race to the bottom argument does not suggest that states will always relax their environmental regulation. Rather, we should expect an asymmetric pattern of state responsiveness that depends on specific and predictable intrastate factors and spatial dynamics. Thinking through these asymmetric relationships leads to more subtle empirical predictions, rather than broad generalizations about state regulatory behavior. Following this behavioral analysis, I examine the factors that motivate and influence state environmental regulatory decision-making, and specifically, the role of concerns about the effects of regulation on private sector investment decisions.

Fundamentally, this dissertation is about how state governments manage the relationship between economic development and environmental protection. My argument is that we cannot understand this issue without focusing on how the institution of federalism shapes state regulatory behavior and the extent to which interstate influences drive state-level regulatory decisions.

The dissertation is organized as follows. In the next chapter, I review the existing theoretical and empirical literature on regulatory competition and discuss its application to the case of U.S. state environmental regulation. I then raise what I believe to be the central

unanswered questions in this area of research, enumerate several hypotheses, and describe my research design to test these hypotheses.

In Chapter 3, I provide a brief history of U.S. pollution control, focusing on the evolving relationship between the federal government and state governments. I describe the regulatory federalism system which shapes the U.S. approach to environmental protection and argue that it provides states with considerable discretion to determine their environmental enforcement effort. Last, I analyze the spatial and temporal pattern of the data I compiled for this project - 20 years of state-level enforcement of the federal Clean Air Act, Clean Water Act, and the Resource Conservation and Recovery Act - and discuss the construction of the dependent variables I study in the analyses that follow.

In Chapter 4, I consider whether there has been convergence in state environmental regulatory behavior. The race to the bottom argument suggests that, over time, state regulatory behavior should become more similar, as states modify their regulatory effort in a manner to level of the playing field for attracting economic investment. If the race to the bottom theory is correct, then we should observe a convergence in regulatory effort at the level of the least stringent state. In this chapter, I consider the case for convergence.

In Chapter 5, I examine several of the key hypotheses underpinning regulatory competition models. Specifically, I estimate a series of strategic interaction models to examine whether a state's environmental regulatory behavior is influenced by the regulatory behavior of states with which it competes for economic investment. While I find clear evidence of strategic interaction in state environmental regulatory behavior, states do not respond in the asymmetric manner suggested by the race to the bottom theory.

In Chapter 6, I revisit the asymmetric responsiveness hypothesis to explore possible explanations for the non-uniform reaction to interstate economic competition shown in the previous chapter. I posit and test the idea that the degree of responsiveness of a state's regulatory behavior to that of competitor states is a function of its susceptibility to the pressures of interstate economic competition.

In Chapter 7, I describe the State Environmental Managers Survey I conducted to address important questions regarding the attitudes and motivations of state environmental regula-

tors. The survey contacted nearly 1500 senior managers in state environmental agencies to learn about the factors that influence state regulatory decision-making, and, specifically, the role of interstate economic competition. The survey data demonstrate that state managers are sensitive to the effects that their regulatory decisions have on industry investment decisions and that they are influenced by policymaking in competitor states. I also consider the mechanism of regulatory competition. In particular, I examine the pattern of information flow regarding economic competition, and the principals that influence the decision-making of state environmental regulators.

Finally, in Chapter 8, I offer some conclusions. In particular, I discuss the implications of this study and identify the remaining unanswered questions that require future research.

Chapter 2. Competition in State Environmental Regulation

Introduction

Competition among states for economic investment has been at times intense over the past few decades.[1] The prevalence of this competition attracted attention in the 1980s and early 1990s due to a series of high-profile bidding wars for new auto manufacturing facilities, in which states offered companies financial incentive packages in the hundreds of millions of dollars (Donahue, 1997). For example, the state of Alabama outbid several other states including North Carolina and South Carolina in the early 1990s, by offering Daimler-Benz an estimated $230 million incentive package for a Mercedes sports-utility-vehicle manufacturing facility. In a more recent example, the State of Illinois and the City of Chicago outbid two other cities in 2001 to attract Boeing's relocation of its headquarters, in large measure, due to an incentive package that exceeded $60 million (Lyne, 2001).[2]

Politicians and other state officials have a number of instruments available to them to promote economic development, any number of which could be used as competitive instruments against other states. Among the many instruments states use to improve their attractiveness to companies include adoption of business-friendly tax policies, subsidization of worker training programs, offers of low-rent land, public investments in infrastructure, and offers of direct financial incentives including industrial development bonds (some tax-exempt) and low-interest state loans.

Most states have created economic development agencies (many with satellite operations abroad) to market their states as good locations for business and to provide assistance to companies interested in locating facilities in their states. These institutions often coordinate substantial incentive packages to companies considering siting new facilities. As noted above, these incentive packages can be quite large, and some states have set aside large funds for this purpose. For example, in 2003, the Texas state legislature created a $295 million "Enterprise

[1]There is an extensive literature describing the nature of economic competition among U.S. states. See Donahue (1997) for a good summary.

[2]The constitutionality of these practices has recently been challenged in court, and is pending a decision by the U.S. Supreme Court.

Fund," which Governor Rick Perry has credited for helping spur economic growth in his state: "Because of the Texas Enterprise Fund, Texas no longer is at a disadvantage when competing for jobs across the country." Others point to the fund as being largely responsible for Texas' rise to the top of a recent ranking of state business climates (Arend, 2004). Evidence on whether these incentive packages result in net benefits to states is mixed, but recent empirical work suggests that such incentive packages can result in modest benefits (Greenstone and Moretti, 2004). Beneficial or not, successful recruitment of new businesses provides an opportunity for elected officials to claim credit for creating jobs, which may take on symbolic significance for voters interested in seeing state leaders take concrete steps to improve their state's economy.

When it comes to attracting manufacturing and other pollution-intensive industries, states may also look for ways to cultivate a facilitative regulatory climate. Recently enacted regulatory reform legislation in Wisconsin provides an illustrative example that state elected officials worry about the regulatory climates of their states. One of the chief sponsors of the legislation argued that: "[j]ob creation has been and continues to be the No. 1 priority of many of us in the Legislature. Hours of hearings have proved that Wisconsin's onerous regulatory climate is driving jobs out of Wisconsin" (Stepp, 2003). Reducing the costs of doing business through regulatory relief may be particularly important for manufacturing industries due to the relatively high costs they must incur to comply with environmental regulations.[3]

There are many ways that states attempt to ease regulatory costs on industries subject to pollution control regulations. First, numerous states over the past decade or so have sought ways to streamline their environmental permitting processes (Rabe, 1999), which is an important factor in industry siting decisions (Gray, 1997a). Second, states currently have in place various pollution control incentives, such as tax-free financing of pollution abatement equipment. Third, most state environmental agencies have compliance assistance programs in which agency staff work directly with firms to help them comply with regulatory standards. Fourth, many states have adopted environmental audit privilege and/or immunity

[3]A recent study by Crain and Hopkins (2001) found that manufacturing firms confront a regulatory burden about six times greater than the average firm, most of which is due to environmental regulation.

legislation,[4] as well as self-policing policies which provide for lower fines when environmental violations are voluntarily disclosed (Stafford, 2004). Finally, states enjoy extraordinary latitude in how they enforce federal pollution control laws. As I discuss in depth in Chapter 3, the institutional design of most federal pollution control programs suggests good reason to believe that states may use their enforcement of these programs as competitive instruments.

The important question for the purposes of my dissertation is whether states use their regulation as a competitive instrument. That is, do states strategically determine their regulatory practices – for example, stringency of standards, permit requirements, enforcement effort – in a way to make their states more attractive to industries? And, if so, does this "regulatory competition" lead to a pattern of state regulatory behavior that systematically reduces environmental protection?

The balance of the chapter proceeds as follows. First, in section 2.1, I examine the theoretical literature on interjurisdictional economic competition and consider the potential that such competition leads states to engage in regulatory competition. I then consider a set of theoretical claims made about the effects of regulatory competition, focusing particular attention on the race to the bottom argument. In section 2.2, I outline a couple of mechanisms that to explain how regulatory competition may work at the state level. In section 2.3., I review the empirical literature that examines the race to the bottom argument, and highlight the ways in which I think this literature fails to test many of the central predictions of regulatory competition. Next, in section 2.4, I enumerate the hypotheses I will test in the empirical work of my dissertation. Last, in section 2.5, I outline the research design I employ to test these hypotheses.

2.1 Interjurisdictional Economic Competition and Environmental Protection

The theoretical literature on competition among governments is quite mature. The foundation of this work is Tiebout's (1956) often-cited model, which argues that interjurisdic-

[4] An environmental audit is a voluntary assessment of a facility, often used to determine its compliance with environmental regulations. Audit privilege protects information collected during an environmental audit from disclosure or use in an administrative or judicial hearing, while audit immunity shields facilities from civil penalties for violations discovered during the course of an audit, as long as the facility returns to compliance. Stafford (2004) provides a good summary of these laws and analyzes the factors that lead states to adopt such measures.

tional competition is a positive force that induces local government actors to provide Pareto-efficient levels of local public goods. Tiebout assumes that citizens are mobile, have perfect information, and are not constrained by employment opportunities. Additionally, he assumes that there a large number of communities that seek to attract their preferred number of residents through their choice of tax and expenditure policies. Tiebout's primary hypothesis is that citizens will move to jurisdictions that provide their preferred basket of local public goods – that is, that citizens will "vote with their feet." Through this mobility mechanism, there is an efficient sorting of individuals into jurisdictions.

Tiebout's model has served as a conceptual stepping stone for what is now an extensive theoretical literature that considers the economic efficiency (or lack thereof) generated by competition among governments. Much of this literature has focused on determining the possible effects of economic competition on tax and other fiscal policies (e.g., Wellisch, 2000; Wilson, 1999; Oates, 1972). Fischel (1975) and White (1975) were the first to directly extend Tiebout's ideas to the context of environmental regulation. In their models, local jurisdictions compete for residents, again through their management of the tradeoffs between attracting capital and providing public goods – in this case environmental protection. The details of their models differ, but Fischel and White each argue that local jurisdictions can utilize tax and zoning policies to compensate residents for the environmental effects of firms' production. In this way, the environmental costs associated with new firms are offset with financial benefits, so any negative impacts of competition for mobile capital are internalized.

Oates and Schwab's (1988) model of economic competition among jurisdictions – still the standard in the field – reaches a similar conclusion to Fischel and White. An important distinguishing feature of their model regards the mobility of citizens. In a departure from Tiebout-like models, they assume that citizens are fixed in their locations, and that instead, states compete for mobile capital. This set up more accurately captures the conditions state governments confront.

In the Oates and Schwab model, "local" communities (i.e., metropolitan areas, states, regions) compete for a fixed stock of capital that is assumed to be perfectly mobile across jurisdictions. Jurisdictions compete for this investment by lowering taxes on capital and/or

by relaxing their environmental standards, since failure to do so would redirect capital to other, more "investment-friendly" jurisdictions. Bringing in new capital investment increases residents' wages, but the jurisdiction must weigh the benefits of this higher income against the loss of tax revenue and environmental quality. Because jurisdictions must compete with other jurisdictions for a fixed supply of capital (i.e., it is a zero-sum game), the community can either attract investment by reducing taxes on capital and/or by easing their environmental standards. In light of this tradeoff, regulators maximize local welfare by setting environmental regulations such that the marginal benefit from attracting capital equals the marginal cost of the incoming capital's environmental effects. The exact level is determined by the jurisdiction's median voter.[5] Assuming no distortions in public choice – that is, that local regulators set policy to maximize the utility of the median voter – each jurisdiction will provide a Pareto-optimal level of environmental protection. Oates and Schwab demonstrate that this outcome leads to socially-efficient results for all jurisdictions in the system.

The central result that emerges from the Oates and Schwab model is that, under conditions of perfect competition, local governments will optimally manage the tradeoff between economic development and environmental protection. That is, state regulators will set environmental standards to the level desired by the citizens in each jurisdiction. Competition, coupled with the median voter rule, in essence, disciplines the behavior of local governments. Although there will be variation in policy choices across space due to heterogeneity in the preferences of median voters across jurisdictions, the welfare of residents in each jurisdiction will be maximized. This central finding has been widely-cited by critics of centralized environmental standard-setting, since it suggests that uniform, national environmental standards will be suboptimal across subnational jurisdictions (e.g., Revesz, 1992, 1997, 2001).

Social scientists have extended the Oates and Schwab model in various ways. For the most part, these extensions corroborate the central finding that competition for economic investment among governments will generate socially-optimal levels of environmental protection

[5]In their base model, residents' preferences are assumed to be homogenous, so the median voter is simply any representative citizen in the jurisdiction. Oates and Schwab also consider the case of heterogenous preferences of residents, in which case they find that regulators – still maximizing the utility of the median voter – will adopt environmental standards that are either too lenient or too stringent, depending on whether or not the median voter benefits directly from new capital brought into the jurisdiction.

across competing jurisdictions. However, this finding is contingent on a host of assumptions, and scholars have demonstrated the fragility of the economic efficiency outcome when these assumptions are relaxed (Wilson (1996), Wellisch (2000), Oates (2001), and Levinson (2003) provide good summaries.). As summarized by Levinson (2003), the models typically assume that there are no interstate externalities; there are many jurisdictions, each large enough such that individuals live and work within the same jurisdiction; regulators maximize public welfare; there are no constraints on policy instruments; and there is no redistribution within the jurisdiction.

In addition, most models of economic competition among governments assume that local regulators do not act strategically with respect to their neighbors, meaning that they do not explicitly compete for mobile capital by responding to competitor states' policies. In other words, states are assumed to not directly compete through their regulation. The economic efficiency results emerge from local regulators making decisions solely on the basis of intra-jurisdictional, not interjurisdictional, factors. But, what if local regulators do respond to external factors when deciding at what level to set their jurisdiction's environmental standards or enforcement efforts? In particular, what if local regulators strategically determine their own environmental regulation in an explicit attempt to gain competitive advantage over other states as part of a strategy to attract new (or retain existing) economic investment?

In this study, I focus my attention on the violation of this strategic behavior assumption – that local regulators (in my case, state officials) strategically determine their environmental regulation vis-à-vis other states. I focus my attention here for several reasons. First, social scientists have demonstrated that state officials often respond to interstate factors when making policy decisions. We know from the policy diffusion literature, for example, that state policymakers often take cues from other states in various policy domains, including lotteries (Berry and Berry, 1990), abortion laws (Mooney and Lee, 1995), education reforms (Minter, 1997), and Clean Air Act permitting (Teske and Gerber, 2004). Besley and Case (1995) also show that, under conditions in which voters look to neighboring states to gauge the performance of elected officials in their own state, incumbent politicians too consider the behavior of these states. In their model, Besley and Case find that incumbent politicians

engage in a type of yardstick competition in the area of taxation, in which they reduce their own tax increases when they are out of line with their neighbors. As I discuss later in this section, Fredriksson and Millimet (2002b) consider a similar yardstick competition model applied to state environmental regulation, and find similar evidence of interstate influence. Collectively, these studies indicate that there is good reason to believe that state governments look to other states when determining their own policy.

A second reason for focusing my attention on strategic government behavior is that there is a great deal of debate in the academic literature about the outcomes of regulatory competition. That is, if states do, in fact, behave this way with respect to their environmental regulation, what is the result of this regulatory competition? This is an important question for the design of environmental governance regimes. Although there are a number of theoretical claims in the literature, many of the central predictions of these theoretical perspectives on regulatory competition have gone empirically untested. In the next section, I outline the three primary claims made in the theoretical literature about regulatory competition, focusing on the race to the bottom argument in particular due to its saliency and the intuitive power of its logic.

2.1.2 Theoretical Effects of Regulatory Competition

There are a number of competing claims in the theoretical literature about the effect of interstate economic competition on environmental regulation. I consider the three most prominent in this section: race to the bottom, race to the top, and no race at all.

Race to the Bottom

Race to the bottom theory is a fixture of the state environmental politics literature, and has spawned vigorous debates among economists (e.g., Levinson, 2003; Oates, 2001) political scientists (e.g., Woods, 2006a; Potoski, 2001) and legal scholars (e.g., Engel, 1997; Esty, 1996; Revesz, 1992).[6] The theory maintains that, confronted with economic competition from other jurisdictions, local regulators may have incentives to adopt excessively lax envi-

[6]Similar concerns are often raised in the international trade context, and are often referred to as "beggar-thy-neighbor" or "ecological dumping."

ronmental standards in an effort to attract mobile capital. These incentives, coupled with the fact that governments may act strategically, may lead states to reduce their standards to gain a comparative advantage over other states. In the context of the U.S. states, a theoretical race to the bottom may occur if a state lowers its environmental standards to attract new industries (or, perhaps, to retain existing industries) in fear of losing this economic investment to lower-standard jurisdictions. If all states reason similarly, the result will be the continued lowering of standards across the states to an uncertain end.

It is important to emphasize that, while the race to the bottom argument is most often conceptualized in terms of environmental standard-setting (Kuehn (1996) is an exception), the logic applies to environmental protection effort more generally. In essence, any regulatory action that states control, as long as it imposes substantial costs on economic investment, may plausibly be used as a competitive instrument. Non-standard-setting examples include environmental enforcement (e.g., differences in enforcement of the same standards creates variation in regulatory compliance costs) and environmental permitting (e.g., differences in approval processes for permits with the same standards also creates variation in compliance costs). In fact, for reasons detailed in the next chapter, there are many reasons to believe that the U.S. states are likely to use their enforcement behavior as a competitive instrument. Nevertheless, for clarity of presentation, I discuss the theoretical case in terms of standard-setting.

The race to the bottom argument is motivated by game theory, and particularly the well-known "Prisoner's Dilemma." Consider the following set up.[7] Imagine there are two jurisdictions – State A and State B – each considering whether to maintain or to relax a now equal environmental standard. (An analogous set up could be postulated in which the decision the jurisdictions face is whether to enact a higher environmental standard or to main an existing environmental standards.) In this scenario, there are four possible outcomes – State A and State B could maintain the existing standard; State A and B could relax the standard; State A could decide to maintain the standard while State B relaxes its standard;

[7]I borrow liberally here from existing applications of the Prisoner's Dilemma game to the interstate economic competition and environmental regulation case. See, for example, Engel (1997), Harrison (1996b), and Brander (1985).

or State B could decide to maintain the standard, while State A decides to relax its standard. Thus, in essence, the states can choose either to maintain (M) their existing standard or to relax their existing standard (R).

Now, consider the following assumptions. If both states maintain their existing standard at the same level of stringency (MM) or both states relax their standard to the same level of stringency (RR), there will be no movement of capital across states – that is, neither will be able to attract economic investment away from the other through lower standards. In this case, we assume that each state will choose to maintain the current standard, since doing so will provide environmental benefits without loss of economic investment ($MM > RR$). In addition, given the ability for a state to achieve the same environmental benefits under two sets of circumstances, the state will prefer the set of circumstances in which it attracts more economic investment. That is, all else equal, states want to attract new jobs away from the other state (i.e., it is a zero-sum game). As a result, both states keeping the standard at the current level will be preferred by each state to only one state keeping the standard ($MM > M$), and one state relaxing the standard will be preferred to both states relaxing the standard ($R > RR$).

In the race to the bottom scenario, it is further assumed that the primary objective of the states is to attract economic investment. This is not to say that the states do not desire environmental benefits as well, just that they desire economic benefits more. This motivates two additional assumptions. First, a state would rather relax its own standard than have both states maintain a higher standard ($R > MM$). Second, the states would rather both relax their existing standard, than have one state maintain its own standard ($RR > M$), because the latter would rather maintain the status quo (i.e., equal regulation) than lose jobs to the former.

If we assume that State A and State B have identical preferences, then each of their preferences are ordered as following: $R > MM > RR > M$. This is the typical order of preferences in the Prisoner's Dilemma game. Table 2.1 summarize the choices and payoffs for State A and State B. If State A and State B maintain their standard at the same level, they will receive the same environmental benefits without upsetting the current allocation

of economic investment in the states (i.e., there is no capital movement) – that is, the status quo prevails and each state receives a payoff of 0. But, if State A chooses to use its regulation as a competitive instrument and relaxes its current environmental standard, it can attract economic investment away from State B. Because the players value economic investment more than environmental protection, State A gains 3 units and State B loses 2 unit (the loss is mitigated by a gain in environmental quality). Finally, if both State A and State choose to relax their standards, neither loses economic investment to the other, but they each lose one unit due to the decrease in environmental quality.

With this payoff structure, the dominant strategy for both State A and State B is to relax their environmental standard. That is, regardless of what the other state does, it is in the interest of the state to relax its own standard. For example, even if State B chooses to maintain its own standard, State A has the incentive to relax its standard to gain a comparative advantage for attracting away some of State B's economic investment. Most importantly, the equilibrium result is suboptimal, since the states would each have been better off from maintaining their standards at the status quo level. In a repeated game, this behavior could spiral to a race to the bottom, with each state continuing to ease their standards in an effort to gain an advantage over the other state.

In the Oates and Schwab model and others like it, the type of strategic behavior inherent in the game theoretic setup is assumed not to exist. The economic efficiency result of these models relies on the assumption that local regulators only consider intrajurisdictional factors when setting environmental standards. However, if these regulators do use their regulation as a competitive instrument and do respond to their economic competitor states' standards, then the suboptimal easing of standards is theoretically compelling.

The race to the bottom argument, taken to its logical endpoint, suggests a literal bottoming out of environmental protection. This is the strong form of the argument, in which states face ongoing pressure to relax their environmental regulation, and that regulatory competition will lead them to reduce their environmental protection efforts to the level of the least stringent state.[8] In such a scenario, we should over time expect to see a conver-

[8]This level may be determined by a regulatory floor put in place by the federal government.

gence of environmental standards, or protection effort more generally, to the level of the least stringent state.

I would argue that there is also a weaker form of race to the bottom argument. While it may not be the case that states "race" toward the least stringent state, some states may nonetheless respond to interstate economic competition by reducing the regulatory costs they impose on industry. The nature of this regulatory competition may, in fact, be more limited. Rather than a system-wide lowering of environmental protection, the effects of regulatory competition may be less uniform. In other words, some states may be more susceptible to the pressures of interstate economic competition than others. This less severe and more subtle interpretation of the argument seems more plausible. I return to this discussion later in the chapter.

There is some anecdotal evidence consistent with race to the bottom-type behavior in U.S. state environmental regulation. One example regards air pollution control policy. Each year, the federal Environmental Protection Agency (EPA) designates each county as either in attainment or nonattainment with national ambient air quality emission standards. Counties designated as nonattainment are required to impose stricter pollution control requirements, which can make it more difficult to attract potential economic investment. For this reason, some states challenge the EPA designations.[9] For example, in 2004, state officials in Tennessee and Arkansas persuaded the EPA to reclassify the Memphis region's air quality ranking for ground-level ozone. Local economic development officials believed that the higher standards would have put them at a competitive disadvantage with other states, with one official claiming that Crittenden County would have been in the running for at least three industrial plants if not for Memphis' non-attainment status (Memphis Business Journal, 2004).

Other examples come from cases where states have complained about what they believe to be lax implementation of national standards in other states. For example, the State of Michigan recently filed an objection with the Alabama Department of Environmental Man-

[9]The EPA recently denied petitions submitted by Georgia, Michigan, Ohio, and West Virginia, asking the agency to remove counties in their states from the list of counties in nonattainment for particulate matter (Samuelsohn, 2006).

agement, accusing it of failing to strictly enforce air emission standards. The officials directly linked this claim of lax enforcement in Alabama with its recent success in recruiting new economic investment projects (Bruns, 2003).

Race to the Top

Some argue that regulatory competition among state governments in the face of economic competition will lead to precisely the opposite outcome of a race to the bottom – that is, more stringent environmental regulation. In a strategic behavior setting, this theoretical phenomenon is referred to as a regulatory race to the top.

The most ardent proponent of this argument is Vogel (1995) who argues that regulatory competition is likely to generate stronger (not weaker) environmental standards. Vogel's argument begins with the presumption that, for most industries, compliance costs with environmental regulation are not sufficiently large enough to be an important factor in private sector investment decisions (as I discuss in the next section, the literature on which Vogel based this assumption no longer represents the consensus finding). For this reason, he argues that neither national governments nor subnational governments have been forced to decide between competitiveness and environmental protection, which has provided them the freedom to increase the stringency of their regulation without fearing loss of economic investment. In the context of U.S. state environmental policy, Vogel points to the example of automobile emissions standards, in which both the federal government and many state governments have over the years adopted California's more stringent air emission standards (I discuss this case in more detail in Chapter 3). Vogel refers to this phenomenon as the "California effect," which he suggests represents a broader phenomenon: "the ratcheting upward of regulatory standards in competing political jurisdictions."[10]

Although the case of automobile emissions standards is the most frequent example of the "California effect," others point to the leadership that states play in various environmental policy areas. In particular, proponents of the race to the top argument point to cases

[10]Although Vogel maintains that the "California effect" applies broadly, the logic applies most directly to product, not process standards. However, Prakash and Potoski (2006) consider voluntary process standards (ISO 14001) in a recent test of Vogel's argument.

where states adopt policies that are more stringent than those of the federal government, as evidence that regulatory competition does not lead to laxity in environmental regulations (Rabe, 2004; John, 1994; Lowry, 1992). However, the mere existence of higher standards in some states does not necessarily mean that states are engaging in strategic interaction in a sort of "follow the leader" type dynamic.

Nevertheless, there are a couple of explanations for why states might adopt more (not less) stringent environmental regulations, despite interstate economic competition. First, some states may not be interested in creating a regulatory climate receptive to investment from pollution-intensive industries, such as manufacturing or mining operations. In these states, environmental quality may be viewed as an amenity worth investing in, rather than compromising. Moreover, they may strive to keep pollution-intensive industries out of their state by setting their environmental regulation so that it deliberately puts them at a disadvantage relative to other states in appealing to these industries. This type of behavior is consistent with the idea of "not in my backyard" environmentalism (NIMBYism), in which regulators put in place exclusionary standards to keep our undesirable types of economic investment (e.g., hazardous waste disposal facilities).

Second, the officials responsible for state environmental regulation may be more "green" than the citizens of their state. If this is the case, their strong personal preferences for stringent environmental regulation may lead them to find ways to withstand pressure from electorally-minded elected officials, business-oriented interest groups, and others potentially more interested in laxer environmental regulation. State regulators, in these cases, may look to other states to determine ways to strengthen their environmental regulation and may peg their own efforts to higher performing states.

In a game-theoretic context, one could imagine a set of circumstances in which states may desire more stringent environmental regulation. Consider a scenario in which a state values environmental quality more than new economic investment. In this context, a state is more interested in competing for environmental benefits from other states, than it is for their economic investment. As before, imagine there are two jurisdictions – State A and State B – each considering whether to elevate (E) or to maintain (M) a now equal environmental

standard.[11] The states will prefer a mutual elevation of the standard to both states keeping their standard, since this would provide more environmental benefits without any loss of economic development ($EE > MM$). A state "racing to the top" will prefer to have a more stringent standard than the other state ($E > EE$). And, a state will desire that both states maintain their standard compared to only itself maintaining the standard ($MM > M$), since the least preferable outcome is to have a less stringent standard than the other state. In this scenario, the order of preferences is $E > EE > MM > M$, which again are assumed to be identical for both states.

Table 2.2 represents payoffs for State A and B with this set of preferences. With these payoffs, the dominant strategy for both State A and State B is to elevate their environmental standard above the status quo level. Regardless of what the other state does, each state is better off elevating its own standard, and the equilibrium outcome is for both states to elevate their current standard. In a repeated game format, the equilibrium outcome will be for each state to continue to ratchet their environmental standard upwards.[12]

As was the case with the race to the bottom argument, the race to the top theory suggests that there will be, over time, a convergence of state level environmental protection effort. Of course, the difference is that instead of converging to the state with the least stringent environmental standards, the convergence will be upward to the state with the most stringent environmental standards.

To my knowledge there is only one empirical paper that has directly tested the race to the top argument in the context of U.S. state environmental regulation. Fredriksson and Millimet (2002a) explicitly model the "California effect" by considering whether states respond to changes in California's pollution abatement expenditures, which is their measure

[11] I follow Harrison's (1996b) example here of the "competitive province."

[12] Fredriksson and Millimet (2002a) consider a similar logic in their model of the "California effect," but the motivating principal in their model is not economic competition. Rather, they consider the case of voters desiring an acceptable ratio of environmental quality relative to pollution abatement expenditures (which is really an issue of policy efficacy more than anything else). Because voters are unlikely to have the information necessary to evaluate this ratio completely, they look to neighboring jurisdictions to weigh how their state compares. Through the electoral mechanism, incumbent politicians must set policy at least at the minimum of the other jurisdictions to satisfy the ratio demanded by voters, which creates a move to adopting more stringent regulation. In this way, a state's environmental policy is a function of what is happening in other states, and trends upward in a race to the top-type dynamic.

of environmental stringency.[13] They find only a modest overall leadership role for California (and a negative relationship for regional neighbors), and, thus, they conclude that there is not much evidence of a race to the top in U.S. state environmental regulation.

No Regulatory Competition?

Both the race to the bottom and the race to the top arguments assume that there is regulatory competition – that is, that state environmental decision-makers are influenced by the regulatory decisions of other states. What if this is not the case? What if, instead, regulatory decisions about standards, permitting requirements, and enforcement levels are based solely on intrastate factors. Stated a bit differently, this means that state regulators do not respond to the regulatory behavior of economic competitor states, but instead base their regulatory behavior on intrastate factors only.

In essence, this is an inference one might take away from the models offered by Oates and Schwab (1988) and others.[14] In these models, local regulators determine their preferred level (generally set at the level of the median voter) of environmental standards by negotiating the tradeoff between economic development and environmental protection. Because of heterogeneous preferences, environmental regulation will differ across the states, but nonetheless will be a function of state-specific phenomena, such as the political economy of the states. For the purposes of this study, therefore, the possibility that there is no environmental regulatory competition among states serves as null hypothesis that there is neither a race to the bottom nor a race to the top in U.S. state environmental regulation.

The lack of regulatory competition suggests a different implication for the convergence of state environmental protection efforts. Rather than converging toward the least or most stringent regulatory state, as suggested by the race to the bottom and race to the top theories, respectively, we should observe no convergence – that is, over time, states' regulatory efforts

[13] As I discuss below, this paper faces the same limitations as much of the empirical studies examining the race to the bottom argument, due its use of the pollution abatement and control expenditures as a measure of state regulation.

[14] In some respects, the assumption of no interstate influences is also made in the literature examining determinants of state level environmental protection (e.g. Hays, et al. 1996; Ringquist, 1993; Lowry, 1992), albeit in more of an omitted variable sense than in a deliberate assumption that economic competition does not effect a state's environmental protection effort.

should not follow other states, but rather set their own path in accordance with intrastate factors.

In sum, although each of these theories is compelling, and has some anecdotal evidence to suggest is plausibility, I focus my empirical work on the race to the bottom argument. I do this for several reasons. First, as I discuss in more detail below, there is a emerging consensus that economic investment decisions are sensitive to interstate differences in regulatory stringency. Second, there is growing evidence that state regulators believe that their regulatory practices influence firm decisions, and that concerns about effects on industry lead to curtailment of environmental regulatory practices. Third, formal models demonstrate that regulatory competition likely leads to excessively lax environmental standards (e.g., Markusen, et al. 1995), although other formal theoretical models show an ambiguous result in which strategic policymaking could lead to either overly-lax or overly-stringent environmental regulations (e.g., Fredriksson and Millimet, 2002b).[15] Finally, while strategic interaction is one of the primary predictions of regulatory competition (and one particularly pertinent to race to the bottom theory), it has not been the subject of much empirical investigation.

Before turning to the existing empirical literature to assess what we do and do not know about the validity of the race to the bottom argument in state environmental regulation, it is first necessary to consider how regulatory competition might work at the micro-level. In particular, what are the mechanisms that might lead state officials to weaken their environmental protection effort in the face of economic competition from other states? I suggest a couple such mechanisms in the next section.

2.2 Mechanisms of State Responsiveness

One could imagine a number of reasons why state officials might choose to ease environmental protection efforts when confronted with interstate economic competition. In the case of U.S. state environmental policy, two seem particularly compelling: electorally-motivated public officials and business-oriented interest groups. In each case, the question is how might

[15]Several models study analogous sets of issues in the context of international trade (Hoel, 1997; Kennedy, 1994; Barrett, 1994) and in the context of tax competition (Wilson, 1999; Wildasin, 1988; 1989.).

the decisions of the state regulators responsible for determining environmental policy deviate from what we might otherwise observe, absent interstate economic competition – that is, if the regulators only were responding to intrastate factors.

First, one must consider the possibility that the electoral incentives facing state elected officials results in a shift of regulatory behavior in the direction of less regulation. State elected officials have much to gain politically from positive economic news. Most models of voting behavior suggest a central role of economic factors in explaining individuals' vote choices, and recent research has demonstrated the importance of economic voting at the state level. Niemi, et al. (1999) found evidence in survey data that citizens base their vote choices in state elections directly on state-level economic conditions, not just national economic circumstances. Some voters may simply vote on a "pocket-book" basis, evaluating the performance (or potential performance) of candidates in terms of their personal economic well-being or that of those they know. Other voters may rely on general indicators of state economic health. Several studies, for instance, have found positive relationships between election outcomes and various state economic and fiscal outcomes (Ebeid and Rodden, 2006; Lowry, et al., 1998; Atkeson and Partin, 1995; Leyden and Borelli, 1995).[16] Other voters may engage in yardstick competition, comparing their own state's economic conditions to those of neighboring states to evaluate how well elected officials are managing their state's economy (Besley and Case, 1995).

The role of economic voting at the state level, therefore, suggests that state elected officials have a clear electoral incentive to do what they can to create economic gains for their states,[17] and there is suggestive evidence that elected officials believe that their electoral fortunes are, at least in some measure, linked to state-level economic growth. For example, Grady (1988) found that nearly 90% of the 104 former governors he surveyed believed that they had responsibility for their state's economy and that corporate decision makers were influenced by gubernatorial actions. In another analysis, Grady (1991) found that, in 33

[16]Ebeid and Rodden (2006) suggest that economic voting at the subnational level is a function of economic geography. Specifically, they show that the relationship between the electoral success of gubernatorial incumbents and macroeconomic indicators depend on the structure of state economies.

[17]A recent analysis by Turner (2003) offers an opposing view. He found a negative relationship between economic development accomplishments and gubernatorial vote share, which suggests that governors do not benefit electorally (in fact, they are punished) from successful recruitment of new industry.

of the 46 (72%) of the 1988 state-of-the-state addresses he analyzed, governors identified economic development as one of their three top priorities. In addition, there is evidence that citizens' assessments of gubernatorial job approval are increasingly linked to state economic conditions (Hansen, 1999).

The argument here is that state elected officials – motivated by their desire to enhance their state's economy to increase their electoral prospects – influence the regulatory behavior of state environmental agencies. One can imagine numerous ways state elected officials might try to influence agency behavior. Governors have the power to set agency agendas, appoint agency heads, recommend budgetary priorities, and, more generally, set the tone for agency behavior. State legislatures meanwhile appropriate government money, conduct oversight of agency actions, institute statutory controls on agency behavior, and have the capacity to create or eliminate public programs. The literature on political control of bureaucracy suggests that these types of tools can be used effectively (e.g., Reenock and Poggione, 2004; Huber et al. 2001; Potoski, 1999).

Before continuing it is important to note that the argument here is not state elected officials, in the interest of economic development, will always sacrifice environmental protection efforts. This unidirectional policy response is far too simplistic to capture the complexity of issues involved in how states manage this tradeoff. In fact, some would argue that this is false tradeoff. State elected officials may view environmental protection as an investment in the local quality of life and as a positive influence on, not an impediment to, economic growth. Some empirical work demonstrates this positive relationship (Meyer, 1995). This is particularly true for regions of the country trying attract firms in non-polluting industries, whose companies and workers place high value on public sector amenities, such as a "clean air" and "clean water." The type of state economy in question, thus, suggests a nonuniformity in state behavior, and is one of a number of asymmetries I discuss in more detail below.

A second group of actors that might influence state regulators are business-oriented interest groups. Business lobbies may attempt to persuade state regulators (or the elected officials that can, in turn, influence state agencies) to reduce the regulatory costs of doing

business in their state. Since pollution control regulation targets particular industries, it is reasonable to assume that affected businesses use the threat of relocation to influence state behavior. Lowry (1992) suggests two forms of this argument. First, one might argue that businesses do relocate to areas where policies match their preferences (presumably, areas with less costly environmental regulation), thereby creating incentives for state policymakers to find ways to ease the regulatory costs they impose. There is an emerging consensus in the social science literature that private sector economic investment does systematically respond to interstate differences in environmental regulatory stringency. Controlling for other factors that influence industry location decisions (e.g., state taxes, public services, labor costs), studies have shown that new domestic industrial plants (List, et al., 2003, Greenstone, 2002, Becker and Henderson, 2000, Henderson, 1996) and foreign direct investment (Hanna, 2004; Fredriksson, et al., 2003; Keller and Levinson, 2002; List and Co, 2000) settle in regions with less stringent environmental regulation. I review this literature in more detail below.

The second, and milder form of the argument, suggests that, whether or not businesses do relocate, state policymakers make decisions as if they do – that is, states modify their regulatory practices due to their perceptions about how industry responds to environmental regulation. In a survey of administrators of state environmental agencies, Engel (1997) found that concerns about the effects of environmental standards on industry location decisions had, at times, influenced agency decisions, and that a substantial minority of states had at some point relaxed their environmental standards in response to such concerns. Moreover, whether accurate or not, business lobbies likely push for regulatory policies that minimize compliance costs, using a message that business climate is an important concern in siting decisions (Davis and Davis, 1999).

Business lobbying might manifest itself on the individual firm level through attempts to influence specific decisions about permitting, compliance schedules, and/or enforcement behavior. Alternatively, business-oriented interest groups might lobby state executive or legislative officials that can, in turn, influence the direction of state environmental regulation.

Understanding the motivation of business-oriented interest groups to lobby state governments for less stringent environmental regulation is straightforward. Less clear is why

state-elected officials, either due to their own electoral interests or at the behest of business lobbies, will knowingly reduce environmental protection if it means deviating from the policy preferences of the median voter. This would seem to contradict median voter theory, but I suggest two reasons why we might expect state elected officials to act in this fashion in this context. First, environmental protection is a second-tier issue for most voters (Lilliard, 2005; Guber, 2001). As noted above, scholarship on voting behavior suggests an important role for economic factors, and political candidates are likely to take action to improve state economic conditions, even if it means compromising another, less electorally-salient policy.[18] Second, there is not much transparency in regulatory behavior. Although regulatory action must conform to various public disclosure requirements, it is reasonable to assume that most citizens are relatively uniformed about the behavior of state bureaucratic agencies. More importantly, most of the instruments that state elected officials have available to them to influence regulatory behavior (e.g., agenda-setting, administrative reform, budgeting) likely escape public scrutiny. Even if they were transparent, it is difficult for most voters to link such decisions with regulatory outcomes. In this way, there may be an asymmetry in information, with elected officials able to make these connections, while the electorate remains uniformed.

To the extent that elected officials and/or business lobbies are interested in creating an investment-friendly regulatory climate in their state, an important constraint is knowing how your states compares to economic competitor states. That is, how do states know if their regulatory behavior places them at a competitive (dis)advantage compared to other states? It seems likely that states would seek out information about other states' regulatory practices, particularly the efforts in those states with which they are in competition. This information may also come directly from industrial representatives with operations in multiple states. States seeking this information, likely then adjust their own regulatory effort such that they are at a competitive advantage, or at least not at a competitive disadvantage. Again, this information may flow through elected officials, who can in turn influence

[18]In a recent paper, List and Sturm (2004) model environmental policy as a secondary policy issue. Using state environmental expenditures data, they find evidence that politicians can selectively appeal to single-issue voters in attempts to attract additional votes. However, this also suggests that incumbent politicians, at times, may find it in their electoral interests to ignore secondary policy issues.

regulatory decision-making. Moreover, when this is considered in a dynamic setting, this suggests that states are frequently weighing their competitiveness relative to other states, and making adjustments to their regulatory climates. Thus, over time, we should observe states strategically determining their environmental protection effort by responding to the regulatory behavior of other states. Detecting this type of strategic interaction between state environmental regulation is essential to validating the existence of regulatory competition, and finding evidence that this regulatory competition pushes environmental protection effort down is essential for concluding that a race to the bottom type dynamic exists. As I explain in the next section, however, the existing empirical literature has not really tested these expectations.

2.3 Review of Empirical Studies of Regulatory Competition

The theoretical potential that interstate economic competition leads to systematic relaxations in state environmental protection has spawned a large empirical literature that purports to examine this relationship. Most empirical studies have focused on the question of whether interjurisdictional differences in environmental regulatory stringency influences private sector investment decisions. Scholars have inferred that, absent such firm behavior, concerns that interstate economic competition leads to less stringent environmental regulation are over-stated, since it is assumed that states would not unnecessarily reduce environmental protection. Therefore, even if states attempted to use their environmental regulation as competitive instruments, such strategies would be ineffective.

Early empirical research on this question found little evidence that firm location decisions responded to interstate variation in environmental regulation. This work was of two basic types: surveys of corporate executives involved in industrial site selection and statistical studies of firm location decisions.

Mostly conducted in the 1980s, a number of surveys asked corporate executives and other business officials about the factors important to industry (re)location decisions.[19] Typically, these surveys asked business leaders to either name or rank the factors they considered to be

[19] A few surveys were conducted in the 1960s, but these did not include questions about environmental regulations (e.g., Mueller and Morgan, 1962; Greenhut and Colberg, 1962)

the most important when deciding where to locate a new facility. In general, these surveys found little evidence that environmental regulations (e.g., air quality standards, environmental permitting requirements) played more than a marginal role in industrial location decisions (Schmenner, 1982; Barker, 1983; Stafford, 1985; Epping, 1986; Calzonetti and Walker 1988). Although respondents in a couple of surveys did claim that environmental regulations were significant factors (Lyne 1990; Davis, 1992), business officials typically pointed to market accessibility and labor costs as the main drivers of industrial location decisions.

A first wave of statistical studies of aggregate industry location decisions also did not support the conclusion that environmental regulations influenced site selection. Bartik (1988) estimated a series of conditional logit models to predict the location of new plants by *Fortune* 500 companies in the 1970s, finding that environmental regulations had only modest effects. Instead, Bartik found that factors such as state taxes, market proximity, public services, labor costs, and unionization laws, were better predictors of site choice. McConnell and Schwab (1990) found similar results in their study of location decisions within the automobile assembly industry; the strictness of air pollution regulation did not have a statistically significant effect on the location of new plants. In a third study, Levinson (1996a) studied firm-level data from the Census of Manufacturers and found that interstate differences in state-level environmental regulation – measured in various ways – had no statistically significant effect on firm location choice of new plants. Thus, by the mid-1990s, the results from these and other studies led to a consensus that environmental regulation was not a central factor in firm decisions about industry location (Levinson, 1996b; Jaffe, et al., 1995).

A second set of empirical studies conducted over the past decade, however, has brought new evidence to bear on this question.[20] Henderson (1996), for example, exploited variation in federal air pollution control regulation to study whether differences in county-level environmental regulation affected the distribution of polluting industries across states. The Clean Air Act established national ambient air quality standards for criteria air pollutants (i.e., carbon monoxide, nitrogen dioxide, ozone, particulate matter, sulfur dioxide, and volatile

[20]The primary reason for the near reversal in findings is methodological. The second wave of studies have examined panel datasets, allowing for scholars to better control for unobserved heterogeneity and the endogeneity of regulations and economic output. Cross-sectional studies cannot differentiate the effect of regulations on economic output from that of economic output on regulations.

organic compounds). The EPA annually designates each U.S. county as either in attainment or non-attainment with the standards for each of these pollutants. Counties designated as nonattainment are required to enforce more stringent air pollution controls for sources of these pollutants than are counties designated as attainment. Henderson examined this variation in county-level attainment status for ozone for the years 1977 to 1987. He found that the designation of a county as nonattainment led to a net exit of plants that were major emitters of volatile organic compounds (precursors to ground-level ozone) from the county, and that counties switching from nonattainment to attainment status, increased the number of polluting establishments by about 8%.

Subsequent work replicated and extended Henderson's findings. Gray (1997b) studied plant-level data compiled from the U.S. Census Bureau's Longitudinal Research Database and found that states with stricter environmental regulation (across various measures) had fewer new manufacturing plant births from 1963-1987. Becker and Henderson (2000) extended Henderson (1996) by studying a longer timer frame (1963-1992). Again examining the effect of county-level ozone attainment status, they found a reduction of plant births for polluting industries in non-attainment areas to be in the range of 26-45%, which represents a significant relocation of polluting establishment from more to less polluted counties. List, et al. (2003) find results of a similar magnitude studying plant relocation decisions using a panel dataset from New York state. Greenstone (2002) advanced this work further, first by considering the county-level attainment status for each of the criteria air pollutants (not just ozone), and then by considering a number of different economic outcome variables. Relative to attainment counties, Greenstone's results suggest that pollution-intensive industries in nonattainment counties lost over a half million jobs, nearly $40 billion in capital stock, and $75 billion of output.

Several studies examining the relationship between foreign direct investment (FDI) and interstate differences in environmental regulatory stringency provide some additional corroborative evidence. List and Co (2000) examined new plant location decisions by foreign multinational companies from 1986 to 1993, finding that these decisions were influenced by differences in state government pollution control expenditures and private pollution abate-

ment expenditures. Keller and Levinson (2002) and List, et al. (2003) find similar effects of state environmental regulation on FDI. Finally, Hanna (2004) studies production decisions of U.S.-based multinational corporations, finding evidence that the corporations subject to stricter air pollution control regulations due to their location in nonattainment counties, increased their outbound FDI.

In addition to investigating the question of whether private sector investment is sensitive to cross-state differences in environmental regulation, there are various other studies that aim to empirically test the race to the bottom argument. Potoski (2001), for example, conducted a survey of state air pollution control programs and found that states had adopted more stringent ambient air and new source emission standards and conducted more ambient monitoring than required by the EPA. He concludes from this evidence that "economic pressures have not overwhelmed the states' ability to set their own environmental standards. There is no evidence of a race to the bottom." Of course, the mere fact that some states have gone beyond EPA standards does not mean that pressure from interstate economic competition has prevented others from doing the same. In his data, sizeable majorities of the states had not done more than required under the Clean Air Act (CAA), which might be an indication of what Esty and Geradin (1997) have referred to as a "regulatory chill," in which states choose not to raise their environmental standards above the regulatory floor set by the EPA.

Moreover, there are alternative ways for states to curtail their pollution control regulation, such as through their enforcement practices. Woods (2006a) finds this to be the case in his analysis of the effects of interstate economic competition on state mining regulation. He finds that the enforcement gap between a state and competitor states – his measure of the imbalance between state regulatory effort – significantly affects the effort put forth by a state to enforce federal mining legislation in a manner consistent with the race to the bottom argument.

Finally, Millimet (2003) and List and Gerking (2000) analyze environmental outcomes data to examine whether a race to the bottom occurred following Reagan's election, a period in which the federal government shifted additional environmental protection responsibility

to state governments. Both papers consider NO_x and SO_2 emissions, and test whether state-level emissions increased after the Reagan Administration came to office. Neither of the papers find evidence that emissions of these criteria air pollutants increased after 1980, and Millimet (2003) actually detects a decline in NO_x emissions. These scholars infer from these results that, because environmental quality did not deteriorate during the post-1980 period, a race to the bottom did not occur. This inference, however, is somewhat awkward. Regulatory competition models do not predict whether environmental quality will increase or decrease; rather, the key question is whether regulatory competition led to a decrease in state regulatory stringency, a question these papers do not address.

Collectively, I would argue that much of the empirical literature aimed at testing the race to the bottom theory as it applies to state environmental regulation fails to directly test most of its central predictions. For example, studying firm responsiveness to interstate differences in regulatory stringency does not address whether states purposely use environmental regulation as a competitive instrument. Regulatory competition theories pertain more directly to *government* behavior, not *firm* behavior. In essence, this research has put the proverbial "cart before the horse" by jumping to study the effects of a theoretical race to the bottom, before studying whether states actually behave as the theory predicts.

This is problematic for several reasons. First, these studies do not address whether state governments behave in a manner consistent with the expectations of theoretical models. They do not, for instance, speak to the factors that motivate and influence the decision-making of the state regulators responsible for setting and enforcing state environmental standards. Do state regulators take into account the effect that their regulatory behavior may have on industrial location decisions? As discussed above, there is good reason to believe that state elected officials and/or business-oriented interest groups will encourage state regulators to curtail state regulation to create a more "business-friendly" state. Yet, we know very little about whether state regulators think in the manner in which these models suggest.

Second, the sources of variation in regulatory stringency exploited in the papers demonstrating economic sensitivity to environmental regulations do not pertain to the case of *state*

environmental decision-making. Several of the papers use county-level attainment status under the Clean Air Act, but this is a federally-determined designation, not one of state policy-making. In fact, as the anecdote about Memphis illustrates, states may fight these designations in fear of their economic repercussions. The other papers generally rely on measures of state environmental commitment such as states' total pollution abatement costs (Gray (1997b) is a notable exception). The structure of these data enable more sophisticated statistical analysis than was previously possible,[21] but it is not clear what they represent. For example, two states could have similar environmental standards, but, due to differences in enforcement efforts, compare quite differently in terms of the pollution abatement costs data. In addition, differences in compliance rates across the states may also generate differences in these costs data. Most importantly, these costs data are not direct measures of state regulatory behavior.

Another weakness in much of the empirical literature examining the impacts of regulation competition is that, with a few recent and noteworthy exceptions (Fredriksson, et al. 2004; Levinson, 2003; and Fredriksson and Millimet, 2002a, 2002b), scholars have not tested for strategic behavior of state governments fundamental to regulatory competition theory. It is the combination of the potential pressure on states to curtail regulatory stringency and the potential for strategic interaction in government decision-making which motivates the race to the bottom theory. Empirical tests of the potential for economic competition to lead to states weakening their environmental regulation in response to other states requires evidence that state regulatory behavior is interdependent. As Woods (2006a, p.177) states, this literature needs "direct empirical assessment of whether the actions of state policymakers respond to the perceived threat emanating from neighboring states when formulating and implementing policy."

Finally, the pattern of strategic interaction among governments should be asymmetric. The logic of the race to the bottom argument is not that all states will respond to all changes in all other states' regulatory behavior. Rather, the theory suggests an asymmetric pattern of responsiveness in which states only take action to modify their environmental regulatory

[21] See footnote 14.

practices when they plausibly put them at a competitive disadvantage. For example, we should observe states reducing their environmental regulatory effort in response to similar reductions (but not increases) by states with which they compete for economic investment.

I would argue, moreover, that these asymmetric patterns are likely to take additional forms. Too often, discussions about races to the bottom (or races to the top) assume that all states are identical. But, states are different in potentially important ways that might help predict the degree to which they are susceptible to the type of interstate economic competition that is likely to lead state regulators to relax their environmental regulation. Important differences might include the size of the state economy relative to competitor states and the proportion of the state economy based in pollution-intensive industries. If these differences in state factors are important, we should not expect all states to respond in a uniform fashion to interstate economic competition.

It is these gaps in the empirical literature that I examine in this study. In the remaining two sections of this chapter, I first enumerate my hypotheses and then my research design for testing these hypotheses.

2.4 Hypotheses

The potential that economic competition creates incentives for state governments to curtail their environmental regulatory behavior in response to other states leads to several testable hypotheses. I enumerate several which I test in the chapters that follow.

As noted above, most of the empirical literature studying the race to the bottom argument considers the question of whether private sector economic investment responds to interstate differences in environmental regulatory stringency. This is an important question, but I believe it is secondary to the question of whether decision-makers in these states think that regulations matter. That is, even if industry does not consider environmental regulations to be an important factor, for example, in where they site a new facility, state officials might behave as if they are an important factor. Stated simply, perceptions matter, particularly if they lead to changes in state regulatory behavior.

I expect to find evidence that state officials believe that environmental regulation has

an effect on private sector investment decisions. Moreover, I expect that these perceptions shape state regulatory behavior – that is, that concerns about the effects of environmental regulation on industry investment decisions lead state regulators to modify their regulatory effort (e.g., relax standards, ease enforcement efforts). These expectations lead to the following two hypotheses:

H_1: State government officials perceive that economic investment responds to the stringency (or lack thereof) of environmental regulation.

H_2: State environmental agencies, at times, modify their regulatory practices in response to concerns that state environmental regulation has an effect on private sector investment decisions.

If states are engaged in an environmental regulatory race to the bottom, we should observe a convergence of regulatory effort over time. Specifically, the race to the bottom argument implies that states' regulatory effort should begin to cluster around the level put forth by the least stringent state (a regulatory race to the top implies a convergence to the level of the most stringent state). This empirical implication suggests the following hypothesis:

H_3: State environmental regulatory effort will, over time, converge to the level of the state putting forth the least environmental regulatory effort.

Environmental regulatory competition among state governments suggests that state environmental regulatory behavior is interdependent. The race to the bottom argument (as does the race to the top argument, for that matter) implies that state regulators base their decisions in part on those of the other states, particularly those states with which they compete for economic development. More specifically, regulatory competition among government assumes that states respond to changes in the regulatory behavior of other states. Thus, we should expect to see strategic interaction in state environmental regulatory practices. This

theoretical interdependence leads to the following hypotheses:

H_4: State government officials are knowledgeable about the regulatory policies and practices of other states, particularly those states with which they compete for economic investment.

H_5: State environmental regulatory behavior responds to the environmental regulatory behavior of competitor states – that is, there is strategic interaction in state regulatory practices.

Strategic interaction among state environmental regulation – while suggestive of regulatory competition – is alone insufficient to support the logic of a race to the bottom. Rather, the race to the bottom argument suggests an asymmetric pattern of responsiveness in which we should observe states reducing their environmental regulatory effort in response to similar reductions (but not increases) by states with which they compete for economic investment. This is not to say that this downward pressure on state environmental regulation will always prevail, but we should observe a general pattern of states responding to their economic competitor states when their environmental regulatory practices can plausibly be argued to put them at a competitive disadvantage. Accordingly, I consider the following hypothesis:

H_6: The pattern of strategic interaction in state environmental regulation will be one in which states respond to competitor states' regulatory behavior, only when this behavior puts them at a disadvantage for attracting new (and retaining existing) economic investment.

Theoretical models of regulatory competition generally do not account for the potentially important ways in which states differ. For instance, the size of a state's economy may affect the degree to which it responds to the regulatory behavior of other states. For example, does New York respond equally to changes in the regulatory behavior of Vermont as it does to changes in the regulatory behavior of New Jersey? I hypothesize that it does not, and more generally, that the degree of state responsiveness to regulatory changes in competitor states will be a function of state economic structure. In particular, I hypothesize that:

H_7: States are more likely to respond to regulatory changes in competitor states, when their economies are smaller than these states, more dependent on pollution-intensive industries, and contain more geographically-mobile industries.

2.5 Research Design

To test these hypotheses, I have collected and analyzed several types of evidence, using a multitude of research methods. To address the first three hypotheses regarding state perceptions and behavior, I conducted a nationwide, web-based survey of senior managers in state environmental agencies, about 1,500 individuals in total. As reviewed above, similar surveys have been conducted of business leaders, but it is the perceptions of the public officials responsible for determining state policies that matter most. I am aware of only one survey (Engel, 1997), conducted about 10 years ago, that asked the right set of questions to the right people. Engel's survey was substantively well-constructed, but covered just a small sample of state officials.

I designed the survey instrument to ask the senior managers about the following subjects: 1) the importance of environmental regulations (relative to other factors) in industry location decisions; 2) whether (and how) concerns about industry investment decisions influence their state agency's regulatory practices; 3) the degree of familiarity that state agencies have with other states' (particularly economic competitors) regulation, and the relative importance of other states' environmental regulations to their own environmental protection efforts; and 4) the degree to which interstate economic competition drives decision-making. The survey provides new evidence about what state government officials' believe about the relationships between environmental regulation, business investment, and state competitiveness, and about the impact that these beliefs have on state agency actions. I discuss the survey design and results in Chapter 7.

To examine the hypothesized strategic interaction of U.S. state environmental regulatory behavior, I have compiled a dataset of state-level enforcement of three federal pollution control programs - the CAA, the Clean Water Act (CWA), and the Resource Conservation

and Recovery Act (RCRA) (regulates the management of waste). The institutional design of these programs is based on a model of regulatory federalism in which, by and large, the federal government (i.e., the EPA) has responsibility for setting national standards, while the details of enforcement are left largely to state environmental agencies. For reasons I detail in the next chapter, this regulatory federalism system provides state governments with considerable latitude in how they enforce federal regulation, creating an opportunity for them to use their enforcement effort (or lack thereof) as a competitive instrument vis-a-vis other states.

I collected this state-level enforcement data from EPA's Integrated Database for Enforcement Analysis (IDEA) database. The IDEA database compiles data from the program specific databases that state and federal officials use to record, track, and measure performance under various federal environmental programs. In particular, I collected facility-level enforcement data for all government actions taken under the CAA, the CWA, and the RCRA since the inception of the programs, though for a variety of reasons most of the analyses I conduct only cover the period since 1985. Since I am interested in state-level enforcement effort, I aggregated the facility-level data into state-year measures. I used these data to create two dependent variables for each program, one measuring the frequency of inspections and the other the frequency of punitive enforcement actions. Collectively, these dependent variables are good measures of a state's regulatory climate, and represent regulatory instruments that states can potentially manipulate in their efforts to out-compete other states for economic investment opportunities. I describe these enforcement data in more detail in Chapter 3.

I use these state-level enforcement data to test the other hypotheses I described above. First, I consider in Chapter 4 whether there has been noticeable convergence in state enforcement behavior, as predicted by (H_3). Subsequently, I estimate a series of strategic interaction models using spatial econometric analysis. These models estimate response functions in which a state's environmental regulatory behavior is modeled as a function of competitor (defined, weighted, and lagged in various ways) states' environmental regulatory behavior. In so doing, I also control for other intrastate political and economic factors that too the-

oretically should influence state regulatory enforcement behavior. I specify these models in various ways first to measure the overall pattern of strategic interaction (H_5), second to test for the asymmetric pattern of strategic interaction suggested by the race to the bottom hypothesis (H_6), and third to test whether state economic structure makes some states more susceptible to the pressures of interstate economic competition, and, thus, more likely to engage in the type of regulatory competition suggested by the race to the bottom argument (H_7). I present the results from these analyses in Chapters 5 and 6.

Table 2.1 Race to the Bottom
Interstate Economic Competition and Environmental Regulation

		State B	
		Maintain	Relax
	Maintain	(0,0)	(-2,3)
State A			
	Relax	(3,-2)	(-1,-1)

Table 2.2 Race to the Top
Interstate Economic Competition and Environmental Regulation

		State B	
		Elevate	Maintain
State A	Elevate	(2,2)	(3,-2)
	Maintain	(-2,3)	(0,0)

Chapter 3. Regulatory Federalism and Environmental Enforcement

Introduction

Environmental protection and, particularly, pollution control, was decidedly a state and local level issue until the 1950s and 1960s. In the 1970s, the federal government capped off a gradual intervention in environmental policy by enacting major pieces of legislation which shifted the balance of power from the states to the federal government. This legislation came on top of a major administrative reorganization of environmental protection responsibilities within the federal government, resulting in the creation of the U.S. Environmental Protection Agency (EPA) in 1970.

Despite this federal assertion of authority, states remained important actors in U.S. environmental regulation. Rather than assume all authority over environmental policy, Congress designed most pollution control programs in such a manner that responsibility was shared by multiple levels of government. Through this regulatory federalism framework, the federal government (i.e., the EPA) has primary responsibility for setting national standards, while state governments are given the task of enforcing these standards for pollution sources within their borders. It is this state regulatory enforcement behavior that I study in the chapters that follow. The purpose of this chapter is first to place this behavior in an historical context and second to describe the pattern of regulatory enforcement in the three pollution control programs I study in this project.

The chapter proceeds as follow. First, in Section 3.1, I summarize the evolution of the role of the federal government in environmental issues. I then describe the main provisions of the three federal pollution control programs I study in this dissertation – the Clean Air Act, the Clean Water Act, and the Resource Conservation and Recovery Act. In Section 3.2, I discuss the institutional design of most U.S. environmental regulation, focusing on the respective roles of the federal government and state governments. Last, in Section 3.3, I describe the state-level enforcement data that I collected for the purposes of this project, and analyze the spatial and temporal patterns of these data.

3.1 A Brief History of the Federal Role in U.S. Pollution Control

For many decades, the federal government was quite reluctant to assume more than an advisory role in U.S. environmental policy. Over the course of the past half century this has changed. A first wave of mostly nonregulatory federal involvement came in the 1950s and 1960s, while a second wave of regulatory involvement came beginning in the 1970s. In this section, I review the gradual expansion of federal authority in environmental policy.

3.1.1 The First Wave

A first wave of federal intervention in pollution control regulation came in the 1950s and 1960s. During this period, the federal government began to redefine the federal-state balance of environmental protection responsibility, albeit gradually. The cases of water pollution control regulation and air pollution control regulation provide illustrative examples.

In the area of water pollution, Congress enacted the Federal Water Pollution Control Act (FWPCA) in 1956.[1] The FWPCA established the Federal Water Pollution Control Administration within the Department of Health, Education, and Welfare (HEW) to organize technical and financial aid, as well as to provide enforcement support to the states.[2] The legislation, however, made clear that primary responsibility for protecting water quality was to remain with the states. The enforcement mechanisms created by the 1956 statute were largely ineffective, and the federal government's main contribution to water pollution control efforts in the years immediately following passage of the FWPCA came through financial grants awarded to states for the construction of municipal sewage treatment facilities (Lieber, 1975).

Dissatisfaction with the progress being made by state governments to address water pollution led Congress to revisit the 1956 legislation about a decade later. The 1965 Water Quality Act attempted to push states into taking more significant steps. The 1965 legislation required states for the first time to establish and submit to the federal government for review

[1]Congress had expressed an interest in water pollution problems in 1948 with the enactment of the Water Pollution Control Act, but this legislation did little more than recognize that water pollution was an important issue to be addressed.

[2]Previously, federal water pollution control responsibilities were handled by the Public Health Service.

specific, quantitative water quality standards for all interstate waters.[3] The law also required states to develop implementation plans detailing how these new water quality standards were to be met. Although the Federal Water Pollution Control Administration was given the responsibility to review state standards, states retained the burden to control water pollution in their states.

Federal air pollution control policy prior to the 1970s was quite similar in approach. The first major federal law passed to address air quality was the Air Pollution Control Act of 1955, which created programs to provide research and technical assistance to state air pollution control programs. During the 1960s, Congress began to extend the federal government's role, enacting three separate pieces of legislation aimed at air pollution – the Air Quality Act of 1960, the Clean Air Act of 1963, and the Air Quality Act of 1967. In general, the purpose of these statutes was to encourage states to voluntarily establish air quality standards, and develop plans to achieve these standards (Ringquist, 1993). The 1967 legislation contain some more ambitious provisions. First, it called for the creation of the National Air Pollution Control Administration within HEW. Second, the law called for the establishment of air quality control regions across the country to organize the monitoring of ambient air quality. Finally, the 1967 act empowered the federal government to develop automobile emission standards, enforceable everywhere but in California, which already had its own more stringent standards.[4] Notwithstanding these new federal efforts, states retained primary responsibility for creating, implementing, and enforcing air pollution control programs.

Collectively, the federal environmental initiatives of this period were nonregulatory and aimed toward supporting, rather than supplanting, state programs. This changed in the early 1970s as a confluence of events and policies led to a major shift in the federal government's role in U.S. environmental policy.

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[3]The 1956 water pollution legislation had authorized states to develop water quality standards, but did not require them to do so.

[4]California was the first state to regulate emissions from mobile sources, in an effort to address its growing problem with smog. In 1960, the state passed the Motor Vehicle Pollution Control Act, which, among other provisions, established a state board to certify mandatory, emission control devices for automobiles. Despite protests from auto manufacturers, the board approved seven such devices in 1962 and required that they be installed in California automobiles by 1965 (Percival, et al. 1992).

3.1.2 The Second Wave

The federal government's intervention in environmental policy in the 1970s had its impetus in a few places. First, there were a couple of highly-publicized, pollution events that focused the public's attention on environmental matters. Two events in 1969, in particular, galvanized public attention: the explosion of a Union Oil Company well six miles off the coast of Santa Barbara, which led to the pollution of 30 miles of California beaches, and the catching fire of the Cuyahoga River in Cleveland from industrial chemical pollution (Layzer, 2002). These events occurred on the heels of Rachel Carson' *Silent Spring* and Paul Ehrlich's *Population Bomb* which, along with other books, had raised attention to environmental issues and helped contribute to the nation's first Earth Day in 1970.

Second, there was a growing a consensus that state governments were failing to make much progress in pollution control (Stewart, 1977; Davies, 1970). State spending and administrative capacity varied immensely across the country and in aggregate, and was viewed to be woefully inadequate by the federal government. For example, only six states were spending the amount of money deemed necessary to address air pollution, and more than half of the states had ten or fewer people working in air pollution control capacities (Lowry, 1992). In addition, there was a lack of cooperation among state governments in addressing the interstate dimension of many environmental problems, which further contributed to lack of progress in curtailing pollution.

Underlying these concerns about state capacity, were questions about the willingness of state and local governments to impose new regulatory costs on industrial polluters (Davies, 1970). States' emphasis on job creation and economic development discouraged them from enacting laws and promulgating regulations that might have a negative effect on existing and potential industry in their state. John Quarles, then the EPA's legal counsel, stated the following during the time that Congress deliberated on the enactment of the 1972 Clean Water Act: "We believe it is really only through the Federal Government that you can have an upgrading of standards, because you cannot expect any State to impose tougher standards that will drive industry away" (U.S. House of Representatives, Committee on Government Operations, 1972). In addition to these general concerns, there was particular

worry that interstate economic competition discouraged states from providing sufficient levels of environmental protection. The House Conference Report accompanying the 1970 Clean Air Act noted that "[t]he promulgation of Federal emission standards for new sources . . . will preclude efforts on the part of States to compete with each other in trying to attract new plants and facilities without assuming adequate control of large scale emissions therefrom" (U.S. Congress, 1979).

Anecdotal evidence suggests that these concerns had some merit. A quote from former Louisiana Governor Edwin Edwards reflecting on how his administration managed this issue is directly on point:

> We have . . . taken the position that the need for . . . stimulation to our economy justified . . . serious tradeoffs, where the environment became either totally or partially damaged. None of us . . . in positions of authority in the state apologize for that. We did what we thought was best for the people and the economy of Louisiana. We accommodated industry where we thought we could in order to get the jobs and the development, and in some instances we knowingly and advisedly accepted environmental tradeoffs." (quoted in Levinson, 1996b).

A third force helping spur federal intervention in environmental regulation during this period was presidential politics, and in particular, competition between Richard Nixon and Senator Edwin Muskie. Whereas environmental issues were nearly non-existent on the presidential agenda in 1968, by 1972 they had emerged as an important issue. As Nixon positioned himself for re-election and as Muskie attempted to win the Democratic nomination, they engaged in what can be best be characterized as a "tit-for-tat" battle to determine who was the better environmental steward. Proponents of more stringent environmental protection exploited this competition to push for more ambitious policies (Layzer, 2002).

The confluence of these three factors led to what Kingdon (1984) would call a policy window. High profile disasters, mounting public attention, and political expediency created the conditions in which legislative action was ripe. On queue, Congress enacted legislation in the 1970s addressing a wide range of environmental issues. Table 3.1 summarizes the main pollution control legislation passed during this period.

This legislation had a couple of things in common. First, the predominant regulatory approach was what is typically-referred to as command and control. Under command and control, regulators develop pollution control standards, conduct compliance monitoring (i.e., inspections), and use sanctions to bring violators back into compliance. Command and control is a rather blunt policy instrument that often requires polluters to meet specific emission-reduction targets, often with prescribed pollution control technology that ignores heterogeneity in facility operations and local environmental conditions. Second, the legislation contained ambitious goals, with often unrealistic deadlines. For example, the 1972 Clean Water Act had among its stated goals the elimination of "all pollutant discharges in the nation's navigable waterways by 1985" by point sources (i.e., "end-of-pipe" sources). In the area of mobile source air emissions, the 1970 Clean Air Act required auto manufacturers to cut emissions of hydrocarbons and carbon monoxide from new vehicles by 90% within five years, despite the fact that there was no known technology for achieving such a dramatic reduction. This latter requirement is an example of the "technology-forcing" nature of many of the pollution control statutes of this period – that is, provisions specifically designed to induce the development of new technologies, often at an unknown cost. Many of the deadlines required by Congress were subsequently extended after it was realized that compliance was unobtainable.

Three statutes enacted in the 1970s in particular – the Clean Air Act (CAA), the Clean Water Act (CWA), and the Resource Conservation and Recovery Act (RCRA) – represent the foundation of U.S. pollution control regulation, as they address pollution releases to air, water and land, respectively. I describe each of these programs in detail below, since they are the programs I study in detail in this dissertation.

3.1.3 Clean Air Act

The 1970 CAA represented the first major federal intervention in environmental policy. Up to this point, federal efforts in the area of pollution control were focused on supporting state and municipal programs. There are three main components of the CAA that deserve discussion here.

First, the CAA required the newly-established EPA to develop National Ambient Air Quality Standards (NAAQS) for five "criteria" air pollutants – carbon monoxide (CO), particulate matter, nitrogen oxides (NO_x), sulfur dioxide (SO_2), and volatile organic compounds (VOCs).[5] More specifically, the CAA required that the EPA set maximum permissible ambient air concentrations for each of these pollutants. Each pollutant actually had two standards – primary standards which were to be designed to "provide an ample margin of safety" to protect human health and secondary standards which were aimed to protect welfare (i.e., aesthetics, property, crops, etc.). Areas not achieving NAAQS would be required to implement stronger pollution control regulations than areas achieving these standards. The CAA directed states to develop State Implementation Plans (SIPS) which, subject to EPA approval, were to specify how each state intended to meet NAAQS. In states failing to develop SIPs, the EPA would develop a federal implementation plan it its place. Initially, states were given only 2 years to submit a plan to the EPA, with all plans supposed to be approved by 1977.

A second central component of the CAA required the EPA to establish New Source Performance Standards (NSPS). NSPS targeted new, stationary sources of pollution (e.g., factories, utilities) and were to be developed on an industry-by-industry basis. These standards were to be engineering-based emission limits, determined according to the best available control technology for each industry.[6] As a sign of the ambition of the CAA, Congress wanted NSPS requirements to be met by 1975. Control of air pollution from existing sources remained a responsibility of state governments, and states were required to include these standards in their SIPs.

Third, Congress expanded the federal role in controlling pollution from mobile sources. Whereas the Air Quality Act of 1967 had authorized the federal government to devise emissions standards for mobile sources, the CAA wrote such standards directly into the legislation. The CAA required a 90% reduction in CO and VOCs by 1975 from 1970 levels and 90%

[5]Later amendments to the 1970 CAA added lead (Pb) and ozone (O_3) (as an indicator for VOCs) to the list of criteria air pollutants.

[6]Almost without exception, phrases such as "best available control technology" and "new source" has been challenged in the courts. Melnick (1983) provides an excellent analysis of the early role of the courts in shaping the CAA.

reduction in NO_x by 1976 from 1971 levels. These reductions were to be achieved through the manufacture of cars and trucks. The California waiver from these national standards, embodied in the 1967 Air Quality Act, was maintained in the 1970 legislation.

The 1970 CAA has been gone through two major rounds of amendments, one in 1977 and one in 1990. The 1977 CAA Amendments made several significant changes. First, Congress once again extended the deadlines set for automobile manufacturers to achieve the mobile source emissions standards written into the original act.[7] Second, Congress extended the timelines regarding various other requirements, including delaying SIP approvals five years to 1982 and delaying compliance with NAAQS to 1987. Third, the 1977 CAA Amendments mandated the use of "scrubbers" in all new coal-fired power plants. This specific technology requirement was aimed at addressing (SO_2) and NO_x) – the main causes of acid rain – and represented a victory for eastern coal interests (Ackerman and Hassler, 1981).

The 1977 CAA amendments also changed the implementation strategy for achieving the CAA's NAAQS. The original act required only areas not attaining NAAQS to institute pollution controls. The Sierra Club sued the EPA on this issue, and in 1972, the U.S. Supreme Court ruled in *Sierra Club v. Ruckleshaus* that SIPs also had to include measures to prevent the deterioration of air quality in areas *already* meeting NAAQS. The Sierra Club argued that without such measures, there would be a migration of pollution-intensive industries from nonattainment areas to attainment areas (Ringquist, 1993). The EPA promulgated regulations in 1974 to comply with the *Sierra Club v. Ruckleshaus* decision, and the 1977 Amendment codified these "prevention of significant deterioration" or PSD regulations into law. This regulatory change did not, however, alter the basic reality that pollution sources in nonattainment areas for one of the criteria air pollutants were still required to meet more stringent pollution control standards and face more rigorous compliance monitoring and enforcement. Moreover, empirical studies have demonstrated that, despite the PSD regulations, there has been a migration of pollution-intensive industries over the past couple of decades from nonattainment to attainment areas (Henderson, 1996; Becker and Henderson, 2000; Greenstone, 2002).

[7]The EPA had already extended these deadlines administratively in 1971, 1972, 1974, and again in 1976.

The 1990 CAA Amendments also made significant changes to federal air pollution control policy. After over a decade of debate and obstruction from the automobile and coal mining industries (and their representatives in Congress), the 1990 Amendments instituted a more aggressive strategy to address "acid rain" by requiring significant reductions in SO_2 and NO_x. Most notably, these reductions were to be achieved through a tradeable emissions market, a marked departure from the command-and-control approach of the rest of the CAA, and the first wide-scale use of a market-based mechanism within federal pollution control. The 1990 Amendments also tightened automobile emission standards for NO_2 and hydrocarbons, and required the use of reformulated gasoline in cities with particularly bad smog problems. The amendments also modified the "California exception," by allowing other states to apply California standards *in lieu* of the less stringent federal standards. As of 2005, fifteen states had opted into at least one of California's more stringent mobile source air emission programs (Environment Maine Research & Policy Center, 2005).

3.1.4 Clean Water Act

The Clean Water Act (CWA) of 1972 was perhaps the most ambitious of the new environmental legislation Congress enacted during the 1970s. The centerpiece of the CWA is the National Pollution Discharge Elimination System (NPDES) which requires that all facilities (e.g., industrial plant, municipal wastewater treatment facility) discharging pollutants into U.S. waterways obtain a permit. NPDES permits are legally-binding documents that specify the frequency, quantity, and location of discharges into waterbodies, as well as permittee monitoring schedules and reporting requirements. Permits were intended to expire after five years, and at which point the EPA was to review and update if necessary effluent discharge limits and other permit provisions. In practice, there has been a large backlog of permits waiting to be renewed, in which case dischargers operate under the conditions of their expired permit.[8]

The CWA requires that discharge limits in NPDES permits be set on the basis of two sets of criteria: technology-based effluent limitations and state-determined water quality stan-

[8]The backlog of NPDES permits is a contentious issue, and the lack of progress in clearing the backlog has been a topic of numerous government accountability reports (EPA, 2005; GAO, 2001).

dards. With respect to the technology-based discharge limits, the CWA required the EPA to develop uniform, national discharge limits for each industry according to the "best practicable control technology" by 1977, and the "best available technology" by 1983. NPDES permits must also meet water quality standards that the CWA required each state to develop. As an initial step, each state was required to evaluate and designate all of its waterways according to their specified use, such as industrial, fishable and swimmable or drinking water. States then were to set water quality standards (numeric and/or narrative) sufficient to protect these designated uses. States could set these standards based on EPA recommended criteria or other scientifically-defensible methods.

A second major set of provisions contained in the 1972 CWA regarded the management of municipal sewage treatment plants. Before enactment of the CWA, municipal sewage facilities discharged their effluent directly into waterbodies, most often without pretreatment. Those municipalities that did pretreat their discharge generally only used primary treatment (i.e., removal of solids through screening and sedimentation). Title II of the CWA aimed to modernize municipal treatment plants through the provision of construction grants (the federal government was authorized to pay up to 75% of construction costs). In exchange for these federal funds, municipal facilities were expected to have in place secondary treatment (i.e., biochemical and mechanical processes to remove dissolved organic materials) capacity by 1977, and "best practicable treatment technology" by 1983.

The CWA has been amended several times, although not since 1987. The 1981 CWA Amendments and the 1987 Water Quality Act both extended the "best available technology" discharge limits, in large measure, due to the slow pace with which EPA had developed these standards. The 1987 legislation took additional steps in two areas largely ignored by the 1972 statute: toxics (e.g., heavy metals, pesticides) and nonpoint source pollution. Although the 1972 CWA required EPA to set standards for toxic discharges, these requirements were largely ignored (Ringquist, 1993). Congress included two new measures in the 1987 legislation that targeted the control of toxics. First, the law required that industrial dischargers of toxics pretreat their effluent before discharging it into municipal sewage systems. This was an effort to relieve the burden and costs otherwise imposed on municipal treatment facilities.

In addition, the 1987 amendments required states to assess their waters to identify which waterbodies were degraded by toxics, and to then modify NPDES permits to address toxic discharges from applicable points sources.

The 1987 Water Quality Act also targeted nonpoint sources of water pollution (diffuse sources of surface water and ground water pollution such as agriculture and stormwater runoff). The original CWA mostly ignored nonpoint source pollution, even though it contributed to more than half of all U.S. water pollution at the time Congress enacted the original 1972 CWA (Gianessi and Peskin, 1981). The 1987 amendments attempted to remedy this omission by requiring states to first determine which waters within their borders were impaired by nonpoint sources, and to then devise plans for addressing this pollution.

3.1.5 Resource Conservation and Recovery Act

The Resource Conservation and Recovery Act (RCRA) of 1976 is the central piece of federal legislation designed to protect land resources from the environmental impacts of wastes. Prior to the RCRA, the federal government had been largely silent on waste issues.[9] The RCRA represented the first comprehensive effort by Congress to manage the handling and disposal of both hazardous wastes (e.g., commercial chemical products, sludge) and solid, non-hazardous wastes (e.g., household trash). Subtitle C of the RCRA addresses hazardous wastes, while Subtitle D of the RCRA deals with solid wastes. I describe each part of the law below, along with other major provisions of the statute.

The hallmark of the RCRA is the regulatory framework for controlling hazardous waste contained in Subtitle C. This section of the act first directed the EPA to develop regulations that define hazardous wastes according to various factors such as toxicity, corrosiveness, and flammability, and then created a "cradle-to-grave" regime of hazardous waste management to track and secure the movement of waste from generation through disposal. Dissimilar to the CAA and the CWA, the RCRA sought to regulate hazardous waste through its entire life-cycle, rather than simply mandate some sort of end-of-the-stack or end-of-the-pipe solution (Percival, et al. 1992). The cradle-to-grave system included a requirement

[9]Congress did enact the Solid Waste Disposal Act in 1965, but this legislation did little more than initiate a research program on solid waste management.

that the EPA create a manifest system to document the movement of waste to insure that hazardous waste was sent only to authorized facilities, and created standards to be met by all transporters of hazardous waste. Finally, this part of the RCRA mandated performance standards and permitting requirements for all facilities engaged in the treatment, storage, or disposal of hazardous wastes. These performance standards regarded the location, design, and construction of these facilities, as well as their operating methods.

The RCRA included a permit program, but not all handlers of hazardous waste were required to obtain a permit to comply with the statute. Facilities – new or existing – treating, storing, and/or disposing of hazardous waste were obligated to obtain a permit, but facilities generating or transporting hazardous waste were not required to obtain RCRA permits, nor were facilities storing hazardous waste for only short periods.

Subtitle D of the RCRA contained provisions pertaining to the disposal of non-hazardous, solid waste. Most of these provisions were non-regulatory in nature, and only required states to take certain actions to improve the safety of solid waste disposal. In particular, the statute directed states to develop solid waste plans, subject to the approval of the EPA. Among the minimum standards specified in the statute for these plans was that states upgrade all open dump sites with sanitary landfills.

Congress amended the RCRA in 1984 and again in 1986. The 1984 Hazardous and Solid Waste Amendments significantly strengthened the control of hazardous wastes. In particular, these amendments required the complete phase out of land disposal of hazardous substances. The 1984 amendments also created a new underground storage tank program for hazardous substances and petroleum (e.g., underground tanks at gas stations) to protect against leakage. The 1986 amendments to the RCRA strengthened the new underground storage tank program by requiring owners and operators of these tanks to demonstrate that they had the financial capacity to clean up any future contamination caused by leaks. The 1984 amendments to the RCRA also authorized what is known as the RCRA corrective action program, which made clear that owners and operators of treatment, storage, or disposal facilities were responsible for identifying, investigating, and cleaning up any accidents occurring at their

facilities.[10]

3.1.6 The Backlash

The CAA, the CWA, the RCRA, and other environmental statutes enacted in the 1970s shifted the balance of government responsibility for pollution control toward the federal government and away from state governments. Since this federal intervention in environmental policy in the 1970s, there have been periodic calls for devolution of environmental policy-making authority back to the states. Presidents Nixon and Reagan, for example, both called for devolution as part of their respective New Federalism initiatives (Nathan, 1983). The Republican-led 104th Congress promoted devolution as part of their calls for increased states' rights (Benenson, 1995). More recently, the Clinton Administration also took concrete steps to give states more power in their administration of federal programs, through the National Environmental Performance Partnership System (NEPPS) initiative. The NEPPS program consisted of formal agreements between the EPA and states to give states more flexibility and to reduce federal oversight. Organizations such as the Environmental Council of the States and the National Governor's Association promote the capacity of state governments to provide environmental protection, although they acknowledge the continuing need for federal financial support. Finally, there is a growing advocacy literature that promotes a federal return of environmental governing authority to states and municipalities (Anderson and Hill, 1997; Butler and Macey, 1996).

As I describe below, too often lost in these discussions about whether the federal government has too much authority to determine environmental policy is the degree of decentralization institutionalized in the federal pollution control programs created in the 1970s. While the federal government undoubtedly extended its own regulatory reach with the set of environmental legislation enacted during this period, the overall governing structure can be best characterized as one of shared authority.

3.2 Regulatory Federalism and Partial Preemption

[10]The RCRA corrective action program is separate from the Superfund program. The RCRA program addresses current mismanagement of hazardous waste at facilities with viable operators and ongoing operations, whereas Superfund primarily addresses sites with historical contamination.

The central institutional design feature of most of the pollution control legislation enacted in the 1970s is regulatory federalism. Under regulatory federalism, public authority to establish and implement regulatory policy is divided between the federal government and state governments (Kelemen, 2004). Guided by this idea of regulatory federalism, Congress explicitly designed responsibility for many pollution control programs such that they were to be shared by multiple levels of government. The key principle defining the relationship between the federal government (i.e., the EPA) and the states in administering these programs is partial preemption. Under partial preemption, federal officials establish national regulatory standards and the procedures by which these standards are to be implemented and enforced. States are then invited or required (depending on the statute) to develop regulatory programs that are consistent – that is, at least as stringent – with federal standards as a condition for being authorized to implement these standards within their borders.[11] In addition to enacting standards, states must demonstrate to the EPA that they have sufficient institutional capacity and legal authority to enforce the programs. Once EPA awards a state authorization for a program, the federal agency pays on average about 50% of the costs of administering the programs (Eisner, et al., 2000). If a state fails to obtain or chooses not to seek authorization – or what is often referred to as primacy – the EPA carries out the programs itself through one of its ten regional offices.

State authorization defines the role of states in most federal pollution control programs, including the CWA and the RCRA, but also in programs addressing drinking water and pesticides. In the case of air pollution, the Clean Air Act requires states to develop State Implementation Plans (SIPs) which detail states' approaches to implementation, maintenance, and enforcement of national primary and secondary ambient air quality standards (Rodgers, 1994). Because the EPA must approve SIPs, this in essence serves a similar function as authorization in other programs.

[11]Formally, there are two ways in which states obtain the legal authority to administer federal programs. The most common method is for states to enact a state version of a federal law and to promulgate implementing regulations. Upon EPA approval, states take control of implementing and enforcing the program, and the EPA serves mainly in an oversight and support role. Alternatively, the EPA can delegate responsibility to states to implement and enforce federal law, but this is an uncommon approach (Rechtschaffen and Markell, 2003). Terms such as authorization, delegation, and primacy are typically used interchangeably to describe the state authorization, and I follow that practice here.

In practice, the EPA grants state authorization on a piecemeal basis, such that states may be delegated responsibility to implement and enforce some parts of the federal pollution control programs, while the EPA retains responsibility for others. For example, the EPA has granted the state of Illinois the authority to carry out the hazardous waste management program under Subtitle C of RCRA, but not the underground storage tank program under Subtitle I. Currently, EPA has authorized about 75% of the major pollution control programs to the states.[12]

There is a small empirical literature that explores the factors that lead states to seek authorization of federal pollution control programs. Crotty (1987) examined the willingness of states to accept primacy during the 1970s and found some evidence that a state's past environmental protection efforts and the power of governors were good predictors of a state's interest in obtaining authorization. Sigman (2003) studied the empirical determinants of authorization under the CWA and the RCRA. Although no single clear explanation emerged from her analysis, she did find evidence that states with larger memberships in environmental organizations received authorization earlier than states with smaller memberships, and that "greener" states sought authorization during less "green" presidential administrations. Woods (2006b) reaches a contradictory conclusion in his recent study of the determinants of primacy. He argues that the assumption of primacy is not indicative of how "green" a state is, but is better predicted by gubernatorial power, public environmentalism, environmental interest group strength, and political culture (in the case of air primacy) and problem severity and state wealth (in the case of water primacy). Finally, Teske and Gerber (2004) studied the authorization of Title V of the Clean Air Act in the 1990s. Title V is a permitting program loosely modelled after the CWA's NPDES permit program that requires large emitters of air pollution to have a permit. Using event history analysis, Teske and Gerber found that states with more heavily Democratic state legislatures received approval for their Title V program faster than states with more heavily Republican state legislatures. They also found some evidence for policy diffusion from neighbors – as the ratio of neighboring states having received Title V authorization increased, so too did the probability that a state would seek

[12]The Environmental Council of the States provides state-by-state and statute-by-statute authorization information on its website: *http : //www.ecos.org/section/states/enviro_actlist.*

and the EPA would approve a Title V authorization.

This system of partial preemption and state authorization sets up multiple possible sources of variation among states in the stringency of their environmental regulatory effort. First, states can adopt more (but, not less) stringent standards. The extent to which states have adopted more stringent standards varies considerably, according to the area of pollution control. For example, with respect to the CAA, Potoski (2001) found that about one-third (11 of 29) of the states responding to his survey indicated that they exceeded NAAQS for at least one criteria air pollutant, while about 20% of the states responding to his survey said their NSPS exceeded the EPA's standards (survey did not specify for which, or how many, industries).[13] Many states have also taken actions to exceed EPA-set hazardous waste management regulations under the RCRA (Lennett and Greer, 1985). Unfortunately, there is not a systematic compilation of these actions, so it is difficult to determine the degree to which state standards exceed federal standards.

Notwithstanding these instances of states adopting more stringent standards, many states have taken explicit action to prohibit such action. As of the mid-1990s, 24 states had enacted legislation specifically forbidding their states from adopting standards more stringent than federal standards, and several Governors in other states had adopted such prohibitions through Executive Orders (Environmental Law Institute, 1996). These restrictions range from broad limitations on state standard-setting such as those in Kentucky and Virginia, to more specific limitations particular to specific programs such as that in New Mexico where the state legislature enacted legislation disallowing its environmental agency from developing standards more stringent than those in the Clean Air Act (Patton, 1996; Organ, 1995). A multitude of reasons likely explain these state actions, but Organ (1995) argues that concerns about economic competition likely influence these prohibitions.

The partial preemption framework also creates a second source of variation in state-level environmental policy – the enforcement of federal standards. Partial preemption provides

[13]More recently, several states have begun to regulate the emissions of CO_2 due to concerns about climate change. Most of these programs are voluntarily in nature, with some exceptions. For instance, the state of Massachusetts has passed legislation requiring six plants to achieve a ten percent reduction of CO_2 from 1997-1999 levels. These efforts are separate from those of a coalition of 12 states (led by California) to regulate CO_2 emissions from automobiles. See Rabe (2004) for comprehensive analysis of actions taken by state government to address climate change.

states with considerable discretion to determine with how much vigor to enforce federal environmental statutes, setting up the potential for cross-state (and within-state, across-time) variation in state environmental regulatory stringency.

Over the years, the EPA has attempted to establish some degree of uniformity in state enforcement behavior. Since the mid-1980s, the EPA has emphasized and codified into policy a deterrence approach to environmental enforcement (Mintz, 2001; Rechtschaffen, 1998).[14] The EPA has clearly specified through national policy guidance that states authorized to enforce federal pollution control programs should too build their enforcement strategies on a deterrence model. While in principle, this should result in broad uniformity (or, at least, reduce variability), there is considerable variation in enforcement performance across the states. I believe two important factors help explain this variation.

First, the EPA's oversight of state enforcement efforts of major pollution control programs has been inconsistent. Outside of its headquarters in Washington, the EPA is organized into ten regional offices, each having coordination and oversight responsibilities for a different set of states. Although EPA regions are supposed to implement the national policies determined at headquarters, they each enjoy considerable autonomy in managing their relationships with state environmental agencies, and this extends into the area of enforcement. The EPA regions themselves have different enforcement philosophies. In part, this reflects the fact that regional administrators have divergent views on enforcement, views that are often shaped by the state politicians and environmental officials that help get them appointed (Mintz, 1995). EPA Inspector General and GAO reports have consistently concluded that regions vary considerably in the way they oversee state-delegated programs and in the frequency with which they intervene with their own enforcement action when states are found to have

[14]In general, there are two main approaches to enforcement that a regulatory bureaucracy such as the EPA can adopt: a deterrence model or a bargaining model. In a deterrence system, emphasis is placed on detecting and punishing violations, with the relationship between the regulator and the regulated best described as one of adversarialism. Regulated entities are assumed to be rational economic actors that will obey laws when the costs of noncompliance exceed the costs of compliance (Becker, 1968). Deterrence models rely on strict, uniform enforcement to punish violators, and, as importantly, to discourage potential violators. In a compliance or bargaining system, regulators are primarily interested in preventing violations and remedying underlying problems. The compliance model builds on the presumption that regulated entities are inclined to adhere to laws, and that noncompliance can be successfully remedied with consultation, technical assistance, and cooperation (Shover, et al., 1984).

not taken sufficient measures themselves (e.g., EPA/OIG, 2005; GAO, 2000; EPA/OIG, 1998). As an example, the GAO found in 2000 that half of the EPA's regional offices had taken no direct actions to implement national EPA guidance on compliance monitoring under the air program. More specifically, the GAO concluded that these five regions "do not implement the strategy and engage in only minimal inspection planning and oversight with their states." Moreover, the EPA has historically had difficulty dealing with recalcitrant states. In congressional testimony in 1989, the EPA Inspector General noted the following:

> [EPA oversight of state enforcement programs] varies from region to region and state to state. Some states have, apparently, a stronger commitment on their own to enforcement activities. And so, it is easier for EPA to deal with them because they're more in tune with what EPA wants to accomplish. Others are more difficult. . . . There is a fragile relationship. On the one hand, EPA has got to seek the cooperation of the states, yet on the other hand it's got to beat them over the head if they're not doing a good job. That's a difficult thing to pull off. And we think there are regions who are falling short of being able to pull that off effectively (quoted in Mintz, 1995, p.75).

Second, the ultimate power that the EPA has to rein in recalcitrant states is to withdraw program authorization. State authorization under partial preemption is neither absolute nor permanent. If a state fails to meet the requirements set forth in federal regulations or does not adequately enforce these regulations, the EPA reserves the legal right, and, in fact, is obligated under the law to take superseding action. If a state persistently fails to implement and enforce the federal statutes, the EPA can remove primacy from the state altogether.

There are several reasons why this is largely an empty threat. First, the EPA has never suspended a state's authorization for failure to meet federal requirements,[15] even in cases where states clearly are not enforcing the federal regulations as envisioned (Sigman, 2003;

[15]In 2003, the EPA did rescind Massachusetts' authorization of the CAA's PSD program, in response to the states refusal to adopt EPA's revised New Source Review rule. In this case, however, Massachusetts viewed the new rule as a weakening of air emissions control standards, and was one of twelve states that unsuccessfully sued the EPA to have the rules overturned (Schlesinger, 2003).

Rechtschaffen and Markell, 2003).[16] Over the past ten years or so, numerous environmental advocacy groups have petitioned the EPA to remove state authorization for various pollution control programs, but none have succeeded. For example, in 1997, environmental groups in Ohio and Colorado unsuccessfully petitioned the EPA to withdraw these states' enforcement powers due to their enactment of environmental audit privilege and immunity laws (Cushman, 1997).[17] More recently, EPA authorization of state NPDES programs have been challenged in 12 states (EPA, 2003).

An example reported by the GAO in 1996 provides further evidence of the EPA's reticence to take over state programs, once authorized. The GAO (1996) reported that the Arkansas Department of Environmental Quality had neither imposed federal discharge limits nor monitoring requirements in its municipal permits for several toxic metals. State officials allowed these municipal facilities to continue operating under expired permits, since re-issuing them would have obligated the state agency to apply EPA-imposed water quality standards for the metals. GAO interviews with Arkansas officials revealed that the state thought the federal standards were too stringent. While officials from the EPA's Region VI office recognized that the Arkansas permits should contain the federal discharge limits, it claimed that the EPA did not have the authority to impose such limits in a state authorized to issue permits. The only option available to the EPA was to take back responsibility for the program, an option that was believed to be unrealistic.

Second, on a pragmatic level, the EPA simply does not have the resources to assume complete enforcement responsibilities in lieu of a state program. In 1993 congressional testimony, then EPA Administrator Browner stated that "[t]here are some States that have seriously considered returning primacy to the Federal government. I will be very honest

[16]In the early 1980s three states temporality returned their authorization to the EPA – Idaho's delegations under the CAA, Iowa's delegations under the Safe Drinking Water Act, and California's delegation under the Clean Water Act's Construction Grant program (Crotty, 1987), but this is a rare occurrence. More recently, Missouri threatened to return authorization for parts of the Clean Water Act due to budgetary shortfalls, but the EPA Region 4 office refused to take over the programs (discussed in Sigman (2003).

[17]An environmental audit is a voluntary assessment of a facility, often used to determine its compliance with environmental regulations. Audit privilege protects information collected during an environmental audit from disclosure or use in an administrative or judicial hearing, while audit immunity shields facilities from civil penalties for violations discovered during the course of an audit, as long as the facility returns to compliance. Stafford (2004) provides a good summary of these laws and analyzes the factors that lead states to adopt such measures.

with you, we don't have the resources to manage even one major State if primacy were to be returned" (quoted in Steinzor and Piermattei, 1998).

In sum, the EPA's ultimate sanction of preemption lacks credibility, and, as a result, states may largely adopt the approach to enforcement that they prefer, even if it deviates significantly from the deterrence approach favored by the EPA. Sigman (2003) concludes in her discussion of state authorization that "once authorized, states have quite a free hand to conduct (or ignore) the program."

The important take away point from this section is that the regulatory federalism and partial preemption framework create a situation in which, practically speaking, we are as (if not more) likely to observe variation in state enforcement, as we are in state standard-setting. The institutional design of most pollution control programs is such that states have considerable discretion to modify their regulatory enforcement behavior, which suggests the likelihood that states interested in using their regulation as an instrument to gain a competitive advantage over their competitors may find it easier to do so with their enforcement behavior than with their standard-setting. For this reason, the focus of my empirical tests of the effects of interstate economic competition on state environmental regulatory behavior is on enforcement. The balance of this chapter describes the enforcement data I collected for these analyses.

3.3 State Enforcement Data

In this project, I study state enforcement of the three central federal pollution control programs comprising the U.S. environmental protection system – the CAA, the CWA, and the RCRA. For several reasons, state enforcement of these federal pollution control programs provides a useful setting for studying whether state governments engage in regulatory competition in environmental regulation. First, enforcement of these federal statutes is carried out through the partial preemption and state authorization system discussed above. In the case of the CAA, upon approval of their required State Implementation Plans (SIPs),[18] states as-

[18]The CAA requires states to develop State Implementation Plans (SIPs) which detail states' approaches to implementation, maintenance and enforcement of national primary and secondary ambient air quality standards.

sume primary responsibility for enforcement of most components of the CAA in their states. With respect to the CWA, most states have sought and received authorization to administer and enforce permits under the National Pollution Discharge Elimination System (NPDES) program, the central pollution control effort of the statute. As of 2005, the EPA had granted all but 5 states (Alaska, Idaho, Massachusetts, New Hampshire, and New Mexico) primacy for the NPDES program. EPA had also granted authorization to all but two states (Alaska and Iowa) to administer the base hazardous waste program (Subtitle C) under the RCRA.

Second, studying variation in state enforcement of federal programs provides a built-in control – that is, there is a common framework from which to examine state agency behavior. Each program has standardized reporting requirements, which provides some assurance that the data are comparable across states and over time. Third, each of these pollution control programs is mature – Congress enacted the CAA in 1970, the CWA in 1972, and the RCRA in 1976. Although Congress has subsequently amended each, the basic structure of the programs' central regulatory regimes have remained relatively unchanged, and studying state enforcement of these programs in more recent years should avoid bias from the early years when states may have been on the steep part of the learning curve.

Finally, state-level enforcement is substantively important. Although the EPA does carry out enforcement actions independently, these largely come in support of state efforts.[19] In 2003, for example, state environmental agencies conducted 96% of the inspections and 88% of the punitive actions in enforcement of the CWA. Additionally, social science research has demonstrated that enforcement imposes real costs on polluters, and is effective in curtailing noncompliance with environmental protection requirements (Nadeau, 1997; Gray and Deily, 1996; Magat and Viscusi, 1990). Before describing the data I compiled for this project, it is useful to briefly summarize the enforcement process in each of these regulatory programs. In terms of the CWA, the focus of this study is the NPDES permit program. As described above, the CWA requires that all facilities discharging pollutants into U.S. waterways have a permit. Discharge limits contained in NPDES permits are based on industry-specific, technology-

[19]There are exceptions, of course. For example, the EPA currently has ongoing, industry-specific enforcement initiatives aimed at electric utilities and petroleum refineries. These initiatives target broader, generally longer-term compliance issues, however, and not single incident violations, which are the focus of this paper.

based standards, as well as state-level water-quality based limits if the technology standards are deemed insufficient to meet the specified waterway's designated uses (e.g., swimmable, fishable). NPDES permits also specify monitoring and reporting requirements which help the relevant regulating agency determine compliance with permit obligations.

Once a permit has been issued, the enforcement process begins with compliance monitoring activities. Permitted facilities are required to submit quarterly discharge monitoring reports, which provide information as to whether facilities are in compliance with their permits. Notwithstanding these self-monitoring requirements, government inspections are the principal means by which government agencies detect violations. In cases where self-monitoring or an inspection detects noncompliance, the state agency (or the EPA regional office in non-authorized states) must determine the severity of the violations and determine that either no further action is necessary or respond with an informal or formal enforcement action. Informal actions include any notification from a state agency or the EPA that a regulated facility is in violation, and range from phone calls to written letters to official notices of violation. Formal actions include more direct measures to move violators back into compliance such as administrative orders, consent decrees, and civil penalties. Formal actions also include civil and criminal judicial referrals to the State Attorney General or the U.S. Department of Justice. EPA guidance delineates that "timely and appropriate" enforcement measures are to be taken to address violations, and, in cases where authorized states fail to take adequate action, the relevant EPA regional office is to step in with superseding action.

The enforcement process under the CAA is roughly analogous to that under the CWA. The primary difference is that instead of a permit-based program,[20] the central component of the program is the SIP, which is the states' strategy for meeting NAAQS – the ambient concentration limits for criteria air pollutants. SIPs are subject to EPA approval, but once approved, states assume responsibility for the implementation, enforcement, and maintenance of NAAQS. In states failing to submit and win approval for SIPs, the EPA can

[20]As part of the 1990 Amendments to the Clean Air Act, most large sources and some smaller sources of air pollution are required to obtain permits, in a program modelled after the Clean Water Act's NPDES program. The Title V program has been slow to get off the ground, and currently EPA has only granted authorization to issue and enforce permits to 15 states. Prior to the Title V program, most states had their own permitting programs, but these varied significantly across the country.

impose a federal implementation plan in their place for the entire state or for air quality control regions within states. From this point forward, the enforcement process generally mirrors that described for the NPDES program. State agencies conduct periodic inspections to monitor facilities' compliance with state air pollution control requirements, and violations are responded to with a similar set of informal or formal enforcement measures.

Finally, the enforcement process for the Subtitle C program of RCRA is also similar. The principal means by which authorized states or a regional EPA office determine a waste handler's (i.e., generator, transporter, or treatment, storage, or disposal facility) compliance with RCRA regulations is through compliance monitoring activities. If compliance monitoring turns up a violation, the relevant government agency can pursue a similar set of administrative, civil, and criminal enforcement actions as under the CAA and the CWA to bring the facility back into compliance.

3.3.1 Enforcement Data

The enforcement data I compiled for this project come from EPA's Integrated Data for Enforcement Analysis system (IDEA).[21] The IDEA system provides a single source of environmental performance data on facilities regulated under various federal pollution control programs, including the three programs I study in this project. IDEA compiles data from the program specific databases that state and federal officials use to record, track, and measure performance. From IDEA, I collected facility-level enforcement data for all government actions taken under the CAA, the CWA, and the RCRA since the inception of the programs. Specifically, the dataset includes all inspections carried out by the EPA or state government agencies and all informal and formal enforcement actions, with the exception of civil and criminal judicial referrals to the Department of Justice which are purged from public access in the IDEA system. Since I am interested in state-level enforcement effort, I aggregated the facility-level data into state-year measures.

I compiled data from the beginning of each of these programs through 2003, though most of the analyses I conduct only cover the period from 1985. I selected 1985 as a starting point

[21]I am indebted to several people at EPA that assisted me in acquiring and understanding these data. In particular, Mary Curtis and Charles Tamulonis were incredibly generous with their time.

for several reasons. First, until the mid-1980s the enforcement program at EPA was largely unsettled. The EPA did not clearly delineate its expectations for state enforcement programs until 1984 when it developed a policy framework to guide their annual enforcement agreements with the states. Prior to this point, the EPA had assumed the dominant enforcement role, often to the dismay of the state pollution control managers previously in control of such efforts within their borders. Although the working relationships between the federal EPA and state agencies improved and the enforcement program survived the Reagan Administration's systematic attempt to dismantle it,[22] the purpose of enforcement was poorly-defined prior to the 1984 policy framework (Mintz, 1995). The 1984 policy framework represented an effort to create a more uniform approach to state enforcement of federal pollution control programs. As part of the framework, the EPA established criteria by which it would evaluate state enforcement programs, calling for semiannual EPA reviews, quarterly state reports on performance measures, and regular EPA evaluations of state progress in addressing significant violations. More importantly, this policy framework explicitly defined the enforcement measures states were to take regarding compliance monitoring strategies and "timely and appropriate" enforcement responsiveness to instances of noncompliance (Rechtschaffen and Markell, 2003; Mintz, 1995).

Second, as a matter of policy, the EPA did not use (or encourage states to use) many of the enforcement tools in its arsenal. For example, during the Ford Administration, the EPA preferred to use administrative orders, rather than judicial action to enforce violations of the CAA and the CWA. This changed when the Carter Administration took office with a new "file first and negotiate later" approach to enforcement, which led to the filing of civil judicial actions as a means to bring violators back into compliance (Mintz, 1995).

Third, data quality from the 1970s through the first half of the 1980s is questionable, with clear indications of lack of consistent reporting in some states. Some problems persist, particularly in the area of reporting violations (data not used in this project), which is not surprising since states face obvious incentives to under-report instances of noncompliance.

[22]The Reagan Administration diminished the enforcement program upon taking office. In 1981, Administrator Gorsuch abolished the Office of Enforcement at EPA Headquarters and the regional enforcement divisions in the EPA regional offices, functions which were moved to offices under closer political supervision. See Mintz (1995) for discussion of the early history of the enforcement program at EPA.

The administrators of the IDEA database, however, maintain that the data are of high quality, and that the enforcement information represents the official data used by the agency (personal communication, Mary Curtis, 05/19/05).

To operationalize state environmental enforcement effort, I have constructed two variables. The first variable reflects the frequency of compliance monitoring, and is essentially an inspection rate measure. In the case of the CWA, I summed the annual number of inspections conducted by states authorized by the EPA to enforce the NPDES program divided by the number of active facilities. I obtained data on the number of active facilities directly from the IDEA database.[23] There are several types of inspections that regulators can conduct in their compliance monitoring efforts, ranging from cursory, "drive-by" inspections to comprehensive sampling inspections. In creating the inspection rate measure, I only consider sampling inspections, since these are the most comprehensive and resource-intensive.[24] I constructed a similar measure with respect to compliance monitoring of CAA regulations. I summed the annual number of inspections conducted by the states – again including only those that include sampling – and divide it by the number of manufacturing establishments in the state. I use the number of manufacturing establishments as an estimate of the number of regulated facilities under the CAA, since the EPA has not historically tracked the universe of regulated facilities. The number of manufacturing establishments in the state are available as part of the U.S. Census Bureau's *Annual Survey of Manufactures*, but not on an annual basis. I imputed data for missing years using linear interpolation. The number of manufacturing establishments is not an ideal measure, but it is suitable proxy. Considering the primary SIC codes of all facilities represented in my data, nearly 50% were manufacturing industries, and about 60% of all enforcement actions in my data took place at manufacturing establishments.[25]

For the RCRA, I summed the annual number of sampling inspections conducted by the states, and divided it by the number of handlers. Again, handlers include generators, trans-

[23]Historically, facilities often had multiple permits (rather than a general permit for all discharges at the facility) so the denominator more precisely is the number of active permits.

[24]Previous work (Helland, 1998b; Hunter and Waterman, 1996) has found that EPA and state environmental agencies use a variety of inspection types in their compliance monitoring strategies. Future research will address this issue more explicitly.

[25]For these purposes, I defined used two-digit SIC codes 20-39.

porters, and treatment, storage, and disposal facilities of hazardous waste. I compiled these data from various years of the EPA's *National Biennial RCRA Hazardous Waste Report.* These data are only available every two years, so I imputed the missing years with linear interpolation.

The second variable represents a general measure of enforcement activity taken by each state in a given year. The measure is the unweighted sum of enforcement actions – informal and formal – taken by state environmental agencies annually, divided by the number (or an estimate of the number) of regulated facilities (defined in the same manner as above). A better measure of the stringency of enforcement would be one that more explicitly measures how states respond to similar instances of noncompliance. That is, do states respond to comparable violations with informal actions or with formal actions, and what factors determine the differences in strategy? Unfortunately, the EPA has not historically collected violations data on a systematic basis, due in part to failure of the states to consistently report this information (EPA/OIG, 1998). Although the measure I use is not ideal, it is consistent with what scholars have used in past studies of regulatory enforcement (Woods, 2006a; Davis and Davis, 1999; Ringquist, 1993; Lombard, 1993; Wood, 1992; Wood, 1991; Hedge, et al., 1991).

3.3.2 Patterns and Trends in State-Level Enforcement

In this section, I explore the cross-sectional and temporal variation in state-level enforcement data. For clarity of presentation, I consider each measure per 100 facilities. First, I consider the overall patterns in state-level enforcement under three federal pollution control programs over the period from 1985 to 2002. I present the time-series for both measures of state enforcement – inspections and enforcement actions – under the CAA, the CWA, and the RCRA. The data presented in the time-series in Figures 3.1 through 3.6 are state-level population-weighted averages. Note that the scales on the y-axis in the figures vary, so comparisons across the measures should be made with care.[26]

Consider the enforcement measures for the CAA. As shown in Figures 3.1 and 3.2, both indicate that there has been a general increase in the number of inspections and enforce-

[26] A main reason for this disparity among the three programs is due to the number of regulated entities used to standardize the data.

ment actions, respectively, taken by states against air pollution sources. In the case of air inspections, on average, states have gone from conducting approximately 9 to 10 inspections per 100 manufacturing establishments from 1985 to 1991 up to about 15 inspections per 100 manufacturing establishments from 1999 to 2002. Over the same period of time, there has been a similar gradual increase in the number of punitive enforcement measures taken in support of the federal CAA. Over the 18-year time period shown in Figure 3.2, there has more than a doubling of enforcement actions, from less than 1 action per 100 manufacturing facilities to about 2 actions.

The pattern of state enforcement of the CWA is somewhat less consistent across the two measures. As presented in Figure 3.3, state inspections (states with NPDES authorization only) taken to monitor compliance with federal water pollution regulation have remained for the most part constant over the period from 1985 to 2002. In terms of the frequency of inspections, the population-weighted state average of water inspections is on the magnitude of 3 to 4 actions per 100 active facilities. With respect to the number of enforcement actions taken to bring violators back into compliance, the pattern under the CWA is not smooth, but overall there has been an increase over the 1985-2002 period. As displayed in Figure 3.4, the population-weighted average number of state enforcement actions taken has ranged from a low of about 3 to 5 actions (with the exception of the 1985-1986) to a high of about 7 to 8 actions, per 100 active facilities.

Last, consider the temporal pattern of state enforcement of federal hazardous waste management regulation over the 1985-2002 time period. In terms of state inspections, as is shown in Figure 3.5, the population-weighted state average gradually increased during this period from about 60 to 75 inspections per 100 handlers from about 1985 to 1993 (notwithstanding a high of approximately 80 in 1986) about 80 to 110 inspections per 100 handlers from 1994 to 2002. Turning to the more general measure of state enforcement activity, there has not been much variation over the 18-year period. With the exception of the large one year increase from 1985 to 1986 and the spike in number of actions in 2000 and 2001, the population-weighted number of annual enforcement actions was in the range of 50 to 65 actions per 100 handlers through most of the period.

Of course, the overall temporal pattern of state-level enforcement hides cross-sectional variation. To provide some indication of the variation in state enforcement behavior, Tables 5.2 through Table 5.4 display the values for each of my measures at four different points in time – 1987, 1992, 1997, 2002 – as well as where each state ranked compared to other states in that year (rankings are in parentheses).[27] There are a few important things to note in these data. First, in any given year, there is considerable variation across these measures of regulatory enforcement. For example in 1992, for every 100 manufacturing facilities, Pennsylvania conducted twice as many inspections under the CAA as its neighbor to the west, Ohio (10.8 compared to 5.4). In the same year, South Carolina performed five times as many inspections as North Carolina in its enforcement of the CWA (15.3 compared to 3.8). The main point here is that, despite the EPA's national policy guidance which is intended to regularize enforcement effort across states, there remains considerable variability in how much effort each state puts forth in enforcing these federal programs.

A second important observation regarding these data is that states vary in how they rank in their enforcement effort relative to other states over time. Some states remain quite consistent in terms of their ranking nationally, whereas others fluctuate. For example, as is shown in Table 3.2, Arizona at each of the 5-year intervals was ranked near the bottom in terms of enforcement of the CAA (across both measures). By contrast, Illinois ranked among the top third of states in its enforcement of the CAA in 1987 and 1992 (across both measures), but fell to the bottom third of the national rankings in 1997 and 2002. New Jersey's use of enforcement actions under the RCRA is another example of a state whose ranking drastically changed over time. In 1987, New Jersey conducted the most enforcement actions per 100 handlers of all other states, but fell all the way to 39th place just five years later. An indication of the within-state across time variation in enforcement are spearman rho correlations of state ranks in enforcement, comparing the state ranks in 1987 to those in 2002, ($r_s = .61, .50$, and $.58$) for inspections taken under the CAA, CWA, RCRA, respectively. The spearman rho correlations are much weaker in the case of the punitive enforcement actions; ($r_s = .21, .34$, and $.43$). While the ranks of the states in these two time periods are positively

[27] I follow the conventional practice in the state politics and policy literature and exclude Alaska and Hawaii from all analyses, including these rankings.

associated, not the levels one see if the states relative enforcement effort was the same over time.

A third noteworthy pattern in these data is that there is variation in how states conduct performance across different programs (at least relative to the other states). In other words, strong performance under one program does not necessarily mean strong performance under another. An illustrative example is West Virginia. In the case of enforcement of the CAA and the RCRA, West Virginia has consistently been among the nation's leaders, at least across the measures considered here. In the case of the CAA, West Virginia was ranked among the top ten states in inspections and enforcement actions per 100 manufacturing establishments in each of the years presented in Table 3.2, with the exception of 1987 when it was ranked 13th. Likewise, the state has been ranked among the top ten in the nation in its enforcement of the RCRA, again with the exception of 1987 when it was ranked 11th in enforcement actions. However, West Virginia's enforcement under the CWA tells a different story. Across each measure, the state has consistently ranked in the middle of the pack in terms of inspections, and among the last ten in enforcement actions. The difference in the state's enforcement of the CWA, perhaps, is indicative of the importance of the mining industry in the state. The more general point is that the degree of state enforcement effort across the three programs considered in this project is not always consistent. This conclusion is reinforced by considering the spearman rho correlations among the rankings of state enforcement efforts. For example, considering the just the inspection rate measures, the correlations across the three programs are positive, but generally weak – $r_s = .14$ for the CAA and the CWA, $r_s = .37$ for the CAA and the RCRA, and $r_s = .07$ for the CWA and the RCRA.

Last, the rankings of state enforcement effort are revealing regarding commonly-held notions about individual states. California, for instance, is often thought to be a state leader in environmental regulatory matters. As I described in Chapter 2, Vogel (1995) has argued that there is "California Effect" in environmental policy, in which other states follow its example of doing more than the federal government requires. While this is certainly true with respect to regulating mobile sources of air pollutants, is California also a leader

in its enforcement practices? The evidence is mixed. While California ranks among the most stringent in its inspection behavior under the CWA (ranking no lower than six in the four years presented in Table 3.3), it is at best a middle-of-the-pack performer across the other enforcement measures. In fact, it ranks at the very bottom in terms of inspections taken to enforce both the CAA and the RCRA. Another state which seems out of step with conventional wisdom is Texas. Although Texas ranks among the lowest in the nation in terms of CAA inspections per 100 manufacturing establishments, it ranks among the top half of states (and among the top ten) in some of the other measures.

Of course, these counter-intuitive results may just be an indication that the enforcement measures do a poor job of characterizing state environmental performance, or at minimum only measure a specific component of state environmental performance. To check this possibility, I present a set of correlation coefficients for my enforcement measures with several other measures of state-level environmental performance in Table 3.5.

The first thing to note is the correlations among the enforcement variables, presented in column (1) through column (6). While for the most part the correlations are positive, they are generally not very strong. The exception is for the two measures of enforcement for the CAA and the RCRA, which are .45 and .44, respectively. These exceptions aside, the low correlations reinforce the point made above that there seems to be considerable variation in state enforcement across measures and across programs. Moreover, the low correlations suggest that each enforcement variable is measuring a different component of regulatory enforcement behavior. For this reason, in the analyses that follow in this project, I am not as much interested in relationships derived from a specific measure, as I am the general pattern of relationships across all of the measures.

The final three columns of Table 3.5 present the correlations between the six measures of state enforcement effort and other measures of state environmental effort. In particular, I consider three widely-used indices of state enforcement effort – the Levinson (2001) industry-adjusted index of pollution abatement costs and expenditures, the Fund for Renewable Energy and the Environment Index (1987) or Free Index, and the Hall and Kerr (1991) Green Index. These indices have been used in various studies as dependent variables

measuring state environmental effort.[28] The Levinson Index is derived from firm-level survey data on pollution abatement costs and expenditures (PACE) compiled by the U.S. Census Bureau.[29] Levinson's index adjusts the PACE data to correct for variation in the industrial composition of states.[30] The Free Index and the Green Index, by contrast, are qualitative indices that scholars created to differentiate and rank state environmental performance. Both indexes consider a wide-variety of factors and indicators of state programs, spending, and environmental conditions across numerous environmental issues.

Consider first the correlations between the enforcement measures and the Levinson Index. Although the correlations are generally positive they suggest only a weak relationship between regulatory enforcement and the costs of state pollution abatement, which suggests somewhat of a disconnect between regulatory enforcement outcomes and the money that firms are spending on pollution abatement. While Levinson (2001) correctly argues that his index measures how much it costs to locate a manufacturing in a facility in a state relative to other states, many of the reasons for these costs are beyond the control of state regulators, and, thus, I think they represent a poor measure of state regulatory behavior. Turning to the Free Index and the Green Index, the correlations suggest a relationship with regulatory enforcement that varies across pollution control programs. The Free Index is negatively correlated with four of the six enforcement measures. By contrast, the Green Index is positively correlated with each of the enforcement measures, with the exception of CWA inspections. The reason for these negative correlations may be that both the Free Index and the Green Index include environmental quality measures, and it is reasonable to assume that state enforcement effort, at least in part, responds to problem severity.

[28]For example, Keller and Levinson (2002), Fredriksson and Millimet (2002a, 2002b) Levinson (2003), and Fredriksson, et al. (2004) all used the Levinson index. More generally, numerous studies have used the PACE data that Levinson used to construct his index, including Williams and Matheny (1984), Crandall (1993), Levinson (1996a), List and Co (2000), and Feiock and Stream (1998). Scholars have also used the Free Index (Hays, et al. 1996; Davis and Davis, 1999) and the Green Index (Bacot and Hunter, 1997; Ringquist, 1993; and Lowry, 1992).

[29]The Census Bureau collected these data annually as part of its Current Industrial Reports: Pollution Abatement Costs and Expenditures (PACE) series from 1977 through 1994 (excluding 1987), and again in 1998.

[30]Levinson's industry-adjusted index is ratio of actual pollution abatement costs in a stat to a prediction of the pollution abatement costs of the state, where the latter is estimated according to national abatement expenditures by industry and the industrial composition of the state.

In sum, these correlations suggest that the enforcement measures constructed for use in the analyses that follow in this project may provide somewhat different measures of state-level environmental effort than measures used in previous studies. Nevertheless, these measures reflect actual state regulatory outcomes, and as such they are particularly appropriate for testing theories about regulatory competition which fundamentally make predictions about state regulatory behavior.

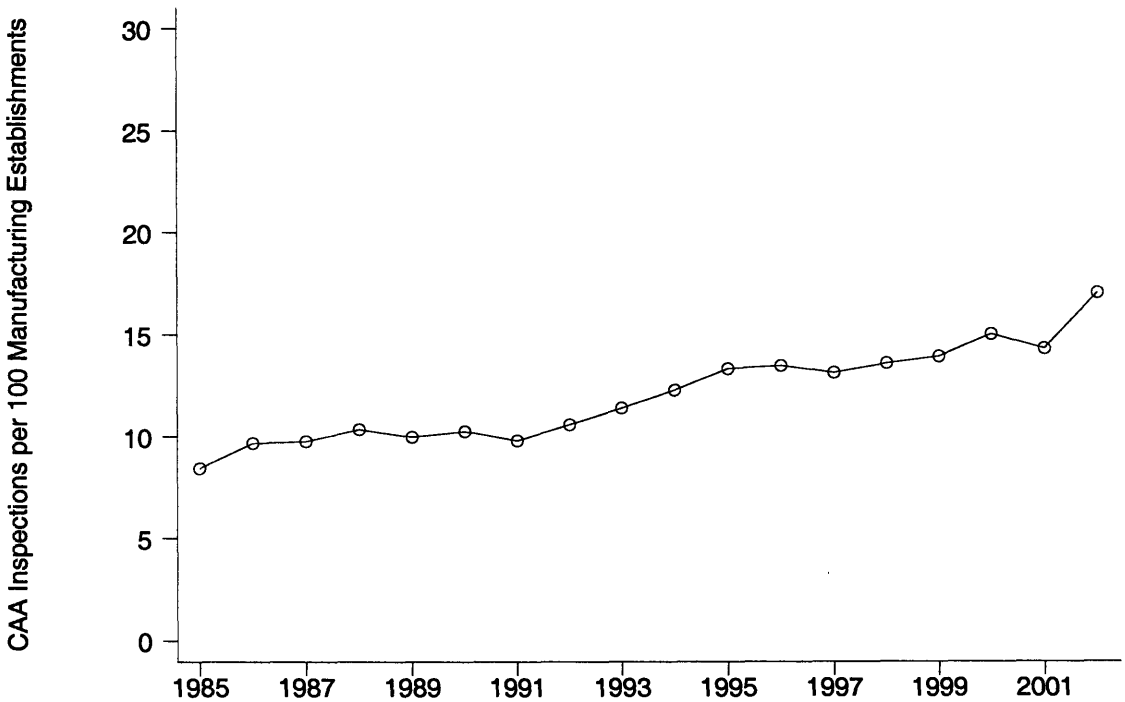

Figure 3.1: Clean Air Act Inspections, 1985-2002

Note: Data are population-weighted state averages. CAA inspections include sampling inspections only, and come from the EPA's Integrated Database for Enforcement Analysis database. The number of manufacturing establishments in each state come from the U.S. Census Bureau's *Annual Survey of Manufactures*. These data are not available annually before 1999, so missing years were imputed using linear interpolation, and 2001 was used as an estimate for 2002.

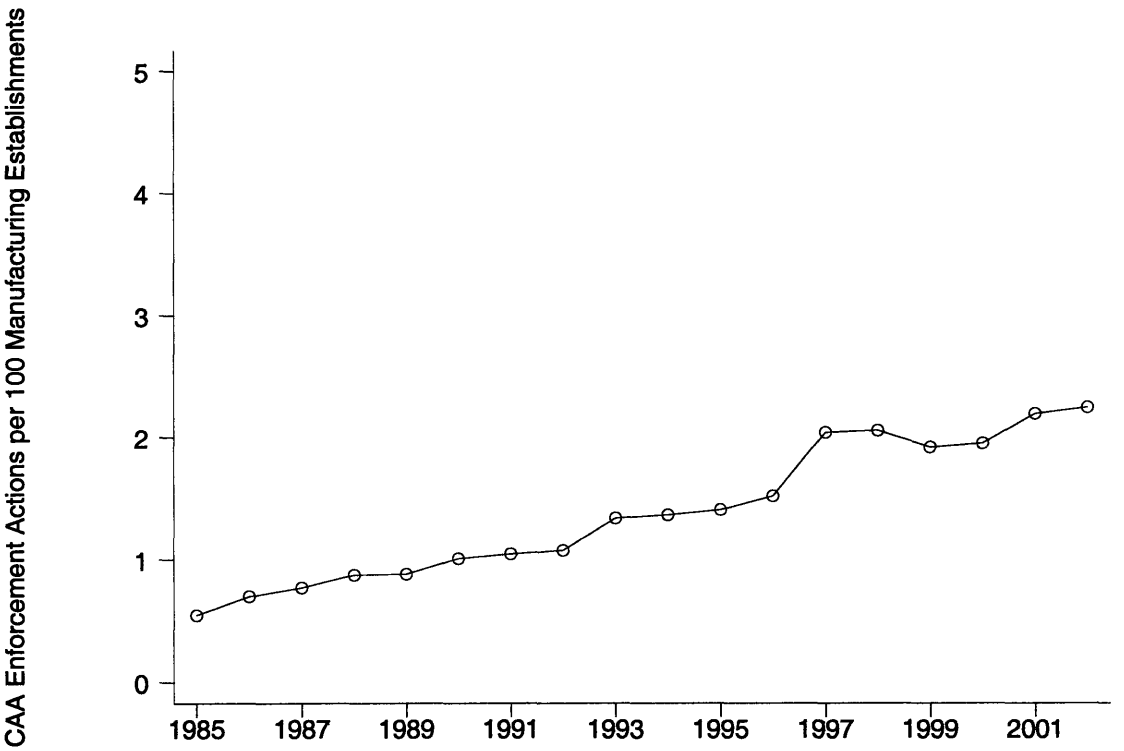

Figure 3.2: Clean Air Act Enforcement Actions, 1985-2002

Note: Data are population-weighted state averages. CAA enforcement actions include all informal and formal actions (excluding civil and criminal judicial referrals), and come from the EPA's Integrated Database for Enforcement Analysis database. The number of manufacturing establishments in each state come from the U.S. Census Bureau's *Annual Survey of Manufactures*. These data are not available annually before 1999, so missing years were imputed using linear interpolation, and 2001 was used as an estimate for 2002.

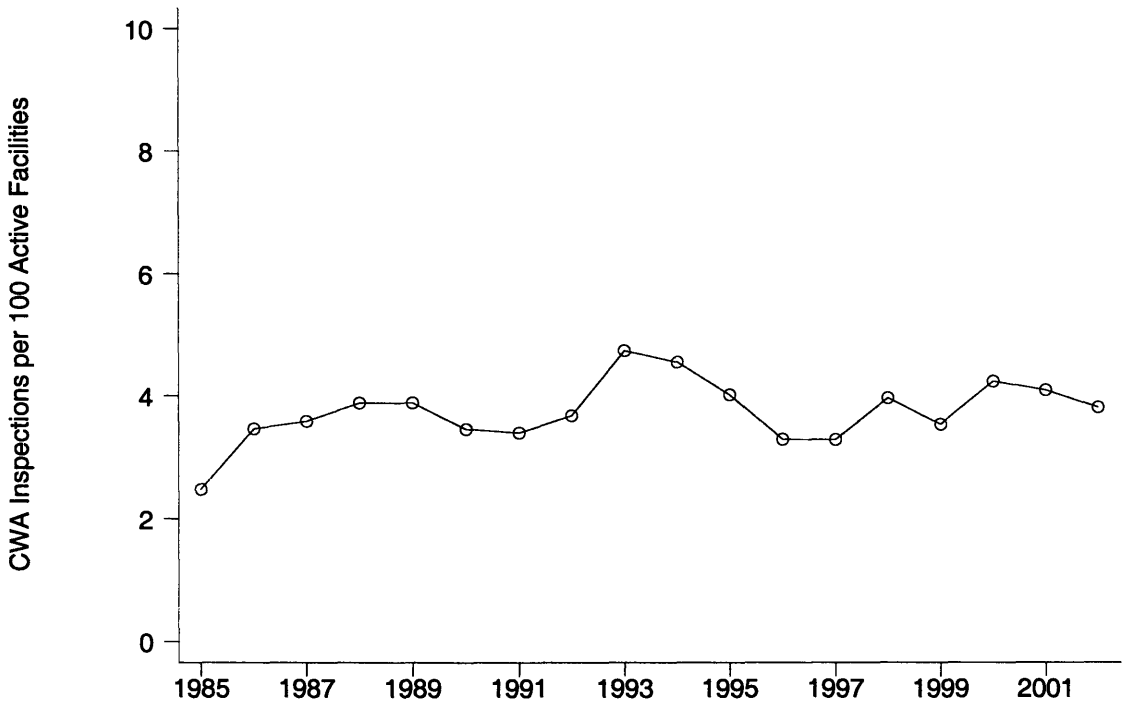

Figure 3.3: Clean Water Act Inspections, 1985-2002

Note: Data are population-weighted state averages, for states with NPDES authorization only. CWA inspections include sampling inspections only. The number of active facilities is the number of active NPDES permits. All data from the EPA's Integrated Database for Enforcement Analysis database.

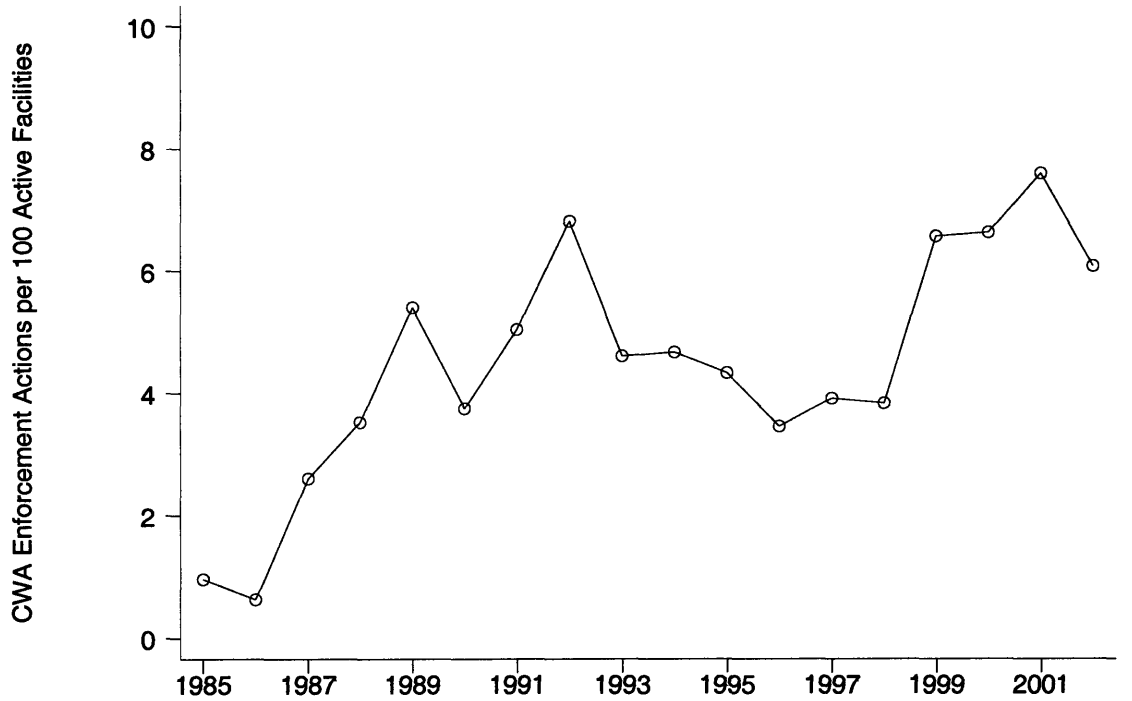

Figure 3.4: Clean Water Act Enforcement Actions, 1985-2002

Note: Data are population-weighted state averages, for states with NPDES authorization only. CWA enforcement actions include all informal and formal actions (excluding civil and criminal judicial referrals). The number of active facilities is the number of active NPDES permits. All data from the EPA's Integrated Database for Enforcement Analysis database.

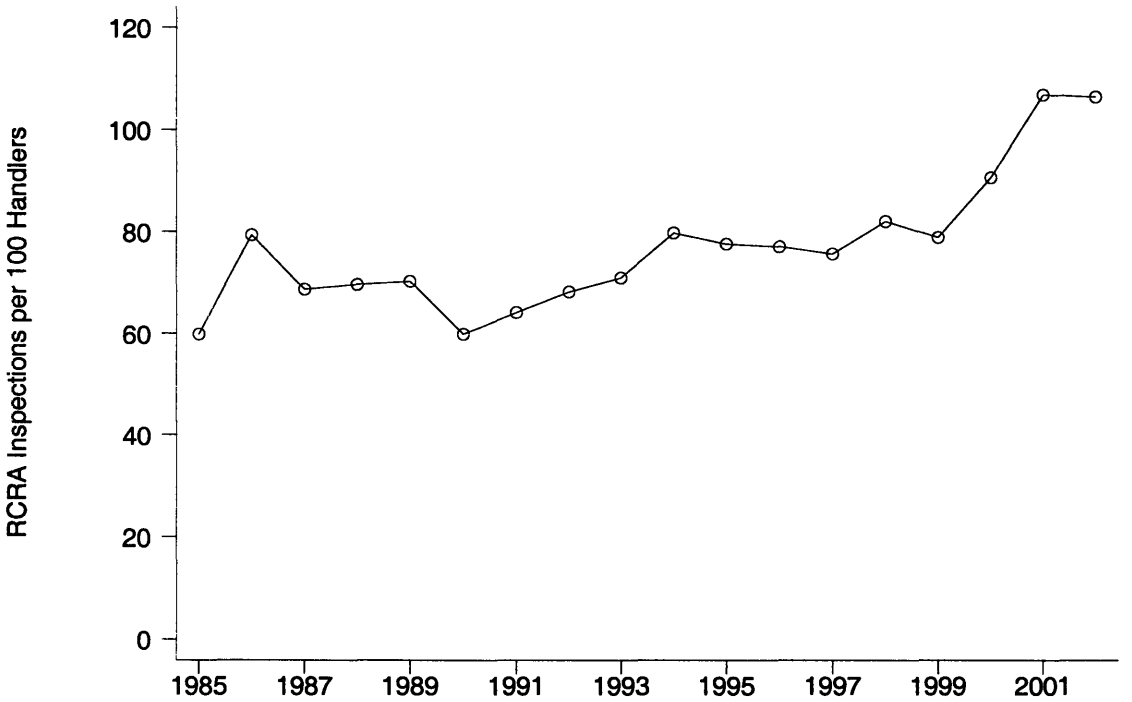

Figure 3.5: Resource Conservation and Recovery Act Inspections, 1985-2002

Note: Data are population-weighted state averages, for states with authorization for Subtitle C (base program) only. RCRA inspections include sampling inspections only, and come from the EPA's Integrated Database for Enforcement Analysis database. The number of handlers is the sum of the number of generators, transporters, and treatment, storage, and disposal facilities of hazardous waste. These data come from various years of the EPA's *National Biennial RCRA Hazardous Waste Report.* These data are not available annually, so missing years were imputed using linear interpolation.

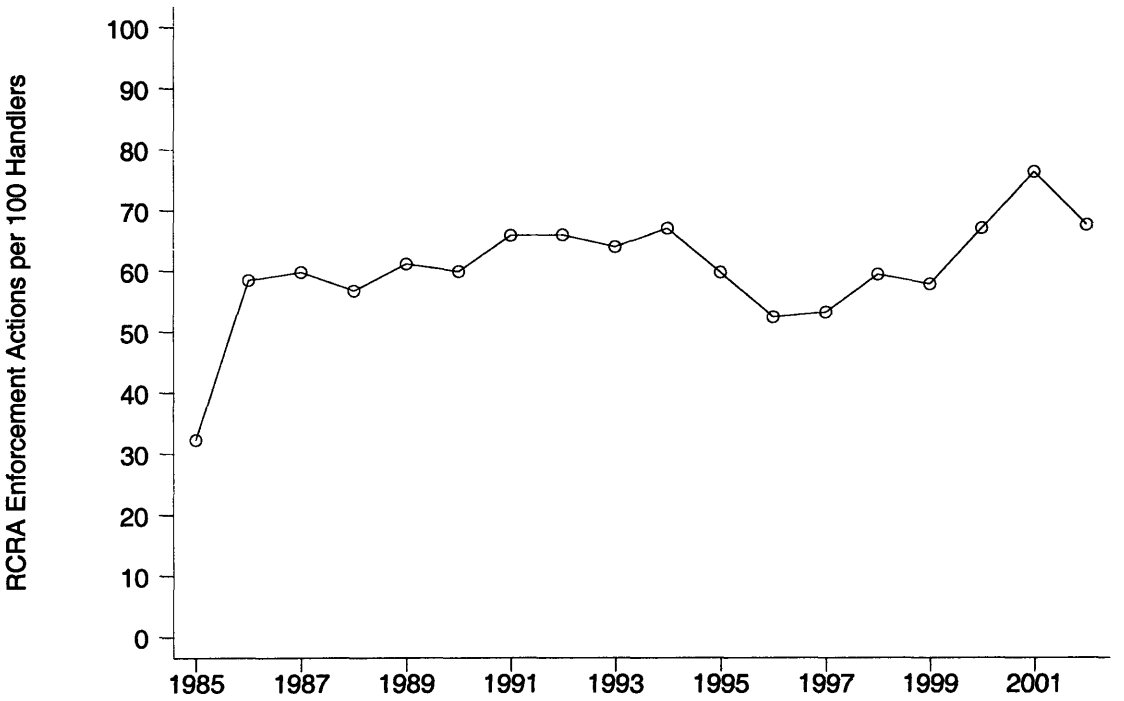

Figure 3.6: Resource Conservation and Recovery Act Enforcement Actions, 1985-2002

Note: Data are population-weighted state averages, for states with authorization for Subtitle C (base program) only. RCRA enforcement actions include all informal and formal actions (excluding civil and criminal judicial referrals), and come from the EPA's Integrated Database for Enforcement Analysis database. The number of handlers is the sum of the number of generators, transporters, and treatment, storage, and disposal facilities of hazardous waste. These data come from various years of the EPA's *National Biennial RCRA Hazardous Waste Report*. These data are not available annually, so missing years were imputed using linear interpolation.

Table 3.1 Major Federal Pollution Control Laws, 1970-1980

Law	*Year Enacted*
Clean Air Act	1970
Clear Water Act	1972
Federal Insecticide, Fungicide, and Rodenticide Act	1972
Safe Drinking Water Act	1974
Resource Conservation and Recovery Act	1976
Toxic Substances Control Act	1976
Comprehensive Environmental Response, Compensation, and Liability Act (Superfund)	1980

Table 3.2 Rankings of State Enforcement of the Clean Air Act, 1987-2002

	Inspections per 100 Manufacturing Establishments				Enforcement Actions per 100 Manufacturing Establishments			
State	1987	1992	1997	2002	1987	1992	1997	2002
AL	22.9 (8)	25.4 (8)	50.1 (3)	89.7 (2)	0.98 (14)	0.9 (27)	1.55 (24)	2.87 (18)
AR	7.5 (29)	12.5 (21)	36.8 (7)	23.3 (20)	0.41 (26)	1.66 (17)	5.84 (6)	2.77 (19)
AZ	1.2 (47)	1.7 (47)	2.8 (47)	5.9 (37)	0 (45)	0.06 (48)	0.06 (48)	0.5 (40)
CA	1.9 (44)	2.1 (46)	3 (46)	3.6 (44)	0 (44)	0.19 (40)	1.1 (28)	0.73 (34)
CO	6.4 (35)	12.1 (22)	17.5 (20)	25.3 (16)	0.81 (19)	0.42 (35)	0.49 (39)	0.21 (44)
CT	6 (37)	5.4 (38)	10.6 (28)	8.5 (32)	1.44 (10)	1.62 (19)	3.05 (14)	3.52 (16)
DE	10.8 (20)	7.9 (31)	18.8 (18)	60 (4)	0.3 (33)	3.26 (5)	0.89 (32)	7.56 (5)
FL	0.1 (48)	5.4 (37)	5.7 (36)	19.8 (23)	0.06 (41)	0.16 (41)	0.43 (40)	0.27 (43)
GA	8.5 (25)	8.1 (29)	7.9 (31)	11.8 (29)	1.64 (8)	2.75 (6)	2.46 (17)	1.68 (24)
IA	18.4 (9)	17.5 (12)	37.4 (6)	39.7 (8)	1.09 (12)	0.72 (31)	4.06 (10)	10.49 (2)
ID	7.4 (31)	9.2 (28)	14.5 (23)	13.2 (27)	0.94 (15)	4.08 (2)	5.96 (5)	6.18 (7)
IL	14.3 (13)	17.2 (13)	8.1 (30)	9.1 (30)	2.2 (5)	1.8 (13)	0.38 (43)	0.63 (36)
IN	11.8 (17)	15.8 (14)	12.7 (25)	1.7 (46)	1.62 (9)	0.8 (28)	0.64 (36)	0.5 (41)
KS	35.5 (4)	33.8 (4)	4.4 (42)	53.7 (6)	0.58 (22)	0.32 (37)	0.82 (34)	3.93 (13)
KY	23.8 (7)	28 (6)	29.2 (10)	24 (19)	0.89 (17)	1.42 (21)	6.94 (3)	2.09 (23)
LA	25.5 (5)	32.1 (5)	44.9 (4)	32.1 (12)	2.07 (6)	2.05 (11)	2.43 (18)	9.16 (3)
MA	10.8 (21)	9.3 (27)	4.4 (41)	6.4 (35)	1.99 (7)	2.49 (8)	2.5 (16)	1.38 (27)
MD	18.3 (10)	27.5 (7)	29.4 (9)	19.9 (22)	0.05 (42)	1.29 (24)	1 (30)	5.83 (8)
ME	7.2 (32)	9.6 (26)	18.4 (19)	13.5 (26)	0 (45)	0.68 (32)	2.16 (20)	2.3 (22)
MI	3.9 (41)	3.8 (44)	6 (34)	6.5 (34)	0.72 (21)	0.56 (33)	0.12 (47)	0.12 (45)
MN	3.7 (42)	7.8 (33)	1.3 (48)	4.5 (41)	0.28 (35)	2.22 (10)	1 (29)	0.73 (33)
MO	8.4 (26)	15.4 (15)	22.3 (14)	18.3 (25)	0.03 (43)	1.34 (23)	1.85 (22)	3.11 (17)
MS	14.7 (12)	15.3 (16)	19.8 (17)	8 (33)	0.24 (37)	0.45 (34)	0.37 (44)	1.48 (26)
MT	7.5 (30)	7.9 (32)	20.6 (15)	36.2 (9)	0.32 (30)	1.6 (20)	3.63 (11)	1.33 (29)
NC	35.6 (3)	18.1 (11)	28.1 (12)	25.2 (17)	0.32 (31)	0.16 (42)	4.28 (9)	6.49 (6)
ND	13.6 (15)	14 (17)	15.4 (22)	29.2 (14)	0.8 (20)	1.65 (18)	0.43 (42)	0 (47)
NE	46.9 (1)	38.4 (3)	37.5 (5)	21.8 (21)	3.62 (3)	2.47 (9)	2.76 (15)	1.24 (31)
NH	6 (36)	10.9 (24)	5.5 (38)	11.9 (28)	0.3 (32)	1.11 (25)	0.43 (41)	0.55 (39)
NJ	8.1 (27)	5.1 (41)	6 (33)	5.3 (38)	0.56 (23)	1.67 (16)	8.37 (1)	3.82 (15)
NM	11 (19)	5.8 (35)	16.3 (21)	32.6 (11)	1.44 (11)	2.01 (12)	4.41 (8)	8.09 (4)
NV	5.8 (38)	5.8 (36)	4.8 (39)	3.8 (42)	0 (45)	0.72 (30)	0.68 (35)	0.06 (46)
NY	5.5 (39)	2.8 (45)	4 (44)	6.1 (36)	0.22 (38)	0.12 (44)	1 (31)	3.93 (14)
OH	8.7 (24)	5.4 (39)	5.6 (37)	4.8 (39)	0.54 (24)	0.26 (39)	0.19 (46)	0.65 (35)
OK	9 (23)	11.7 (23)	14.1 (24)	35.3 (10)	0.27 (36)	0.76 (29)	1.35 (27)	5.48 (10)
OR	7.8 (28)	7.9 (30)	7.7 (32)	1.4 (47)	0.88 (18)	1.38 (22)	1.41 (26)	0.43 (42)
PA	10.4 (22)	10.8 (25)	28.9 (11)	47 (7)	0.38 (29)	2.71 (7)	5.07 (7)	4.58 (11)
RI	2.6 (43)	4.3 (43)	5.8 (35)	4.5 (40)	0.38 (28)	0.08 (47)	0.55 (37)	0.81 (32)
SC	11.3 (18)	12.7 (19)	20 (16)	57.5 (5)	0.51 (25)	0.1 (46)	1.94 (21)	2.71 (20)
SD	1.8 (45)	13 (18)	10.9 (26)	18.7 (24)	0.39 (27)	0.11 (45)	1.47 (25)	0 (47)
TN	13.1 (16)	12.7 (20)	10.7 (27)	24.7 (18)	0.16 (39)	0.13 (43)	0.54 (38)	2.44 (21)
TX	6.5 (34)	5.1 (40)	4.3 (43)	1.3 (48)	2.24 (4)	1.73 (15)	3.57 (12)	1.62 (25)
UT	13.7 (14)	24.5 (9)	25.4 (13)	28 (15)	3.65 (2)	4.44 (1)	6.13 (4)	4.14 (12)
VA	16.4 (11)	43 (1)	53.7 (1)	69 (3)	0.29 (34)	1.73 (14)	2.4 (19)	1.3 (30)
VT	4 (40)	4.9 (42)	8.5 (29)	8.6 (31)	0.16 (40)	0.3 (38)	1.8 (23)	0.61 (37)
WA	1.7 (46)	1.5 (48)	3.9 (45)	3.6 (43)	0 (45)	0.35 (36)	0.87 (33)	1.37 (28)
WI	7 (33)	6.7 (34)	4.6 (40)	3.4 (45)	0.9 (16)	0.99 (26)	0.35 (45)	0.57 (38)
WV	24.3 (6)	22.7 (10)	50.9 (2)	121.1 (1)	0.99 (13)	3.47 (4)	7.54 (2)	5.71 (9)
WY	43.6 (2)	40.2 (2)	33.2 (8)	30.6 (13)	4 (1)	3.99 (3)	3.18 (13)	11.25 (1)
μ	12.3	13.7	17.3	23.5	0.87	1.36	2.30	2.9
σ	10.6	10.6	14.3	24.3	0.97	1.16	2.15	2.9
n	48	48	48	48	48	48	48	48

Note: Rankings are in parentheses. Inspections include sampling inspections only. Enforcement actions include all informal and formal actions (excluding civil and criminal judicial referrals). Enforcement data come from the EPA's Integrated Database for Enforcement Analysis database. The number of manufacturing establishments in each state come from the U.S. Census Bureau's *Annual Survey of Manufactures*. These data are not available annually before 1999, so missing years were imputed using linear interpolation, and 2001 was used as an estimate for 2002.

Table 3.3 Rankings of State Enforcement of the Clean Water Act, 1987-2002

	Inspections per 100 Active Facilities				Enforcement Actions per 100 Active Facilities			
State	1987	1992	1997	2002	1987	1992	1997	2002
AL	1.3 (26)	1.09 (29)	0.98 (26)	1.34 (23)	0.21 (24)	0.5 (24)	0.09 (37)	6.02 (12)
AR	0.72 (32)	2.04 (20)	1.73 (19)	1.24 (26)	2.12 (6)	89.58 (2)	60.47 (1)	59.5 (1)
AZ								
CA	7.2 (6)	8.36 (3)	6.83 (6)	9.31 (5)	0.2 (25)	0.3 (31)	0.63 (25)	0.81 (26)
CO	7.16 (7)	4.22 (11)	0.06 (37)	1.77 (19)	0.29 (21)	0.45 (26)	0.23 (31)	0.25 (30)
CT	13.82 (3)	4.31 (10)	3.85 (11)	4.49 (10)	1.56 (9)	2.52 (11)	0.26 (30)	1.53 (20)
DE	4.52 (13)	6.16 (5)	33.61 (1)	33.96 (1)	0 (32)	1.37 (20)	0 (39)	0 (40)
FL			1.15 (24)	1.66 (20)			0.19 (32)	0.16 (33)
GA	7.47 (5)	13.23 (2)	12.73 (3)	13.87 (2)	7.43 (3)	5.31 (7)	14.65 (6)	11.57 (10)
IA	5.77 (10)	4.63 (8)	6.58 (8)	6.59 (8)	3 (5)	7.25 (5)	15.6 (5)	14.58 (8)
ID								
IL	1.57 (22)	1.36 (26)	0.51 (32)	0.83 (32)	2.1 (7)	1.94 (15)	4.68 (8)	3.48 (14)
IN	1.39 (24)	1.1 (27)	0.03 (39)	0 (38)	1.22 (10)	4.4 (8)	3.09 (12)	6.05 (11)
KS	0.47 (34)	0.91 (32)	0 (40)	0 (38)	0.06 (30)	0.06 (35)	0 (39)	0.36 (28)
KY	1.01 (28)	2.45 (19)	1.88 (18)	1.26 (25)	0.3 (20)	1.56 (19)	0.94 (19)	0.83 (25)
LA			0.62 (29)	3.43 (12)			3.28 (11)	37.88 (3)
MA								
MD	6.62 (8)	7.14 (4)	11.12 (4)	12.11 (3)	0.77 (12)	2.52 (12)	0.93 (20)	0.91 (24)
ME				2.18 (16)				0.31 (29)
MI	1.22 (27)	1.04 (30)	1.19 (23)	2.92 (13)	0.22 (23)	0.45 (25)	0.26 (29)	0.15 (34)
MN	0.17 (36)	0.65 (33)	0.03 (38)	0.67 (34)	3.15 (4)	5.53 (6)	0.72 (23)	0.95 (23)
MO	0.99 (30)	0.24 (37)	0.27 (34)	0.71 (33)	0.1 (27)	0.1 (33)	0.04 (38)	0.09 (36)
MS	3.42 (16)	4.16 (12)	2.31 (15)	2.48 (14)	0.34 (19)	1.81 (16)	7.26 (7)	2.03 (16)
MT	3.43 (15)	3.49 (15)	6.78 (7)	9.28 (6)	0 (32)	0 (37)	3.44 (10)	18.3 (6)
NC	5.68 (11)	3.81 (13)	6.99 (5)	1.13 (27)	0.07 (29)	2.23 (13)	0.68 (24)	0.05 (39)
ND	6.6 (9)	3.4 (17)	0.46 (33)	2.09 (17)	0 (32)	0.11 (32)	0.15 (33)	0 (40)
NE	0.49 (33)	0.54 (35)	0.24 (35)	0.98 (30)	0.04 (31)	0.4 (27)	0 (39)	0 (40)
NH								
NJ	1.63 (21)	3.12 (18)	4.37 (10)	4.33 (11)	27.8 (1)	92.56 (1)	24.99 (2)	1.34 (22)
NM								
NV	2.08 (19)	1.09 (28)	2.95 (14)	1 (28)	1.04 (11)	0.36 (28)	0.84 (21)	0 (40)
NY	0.99 (29)	0.59 (34)	0.58 (31)	6.26 (9)	1.88 (8)	1.75 (17)	0.61 (26)	1.37 (21)
OH	2 (20)	3.41 (16)	3.36 (13)	1.27 (24)	9 (2)	9.31 (3)	3.83 (9)	0.66 (27)
OK			0.71 (28)	0.2 (37)			22.31 (3)	17.99 (7)
OR	0.46 (35)	4.98 (7)	1.96 (17)	2.48 (15)	0.34 (18)	2.06 (14)	1.67 (15)	1.58 (18)
PA	1.45 (23)	1.45 (24)	1.39 (21)	0.91 (31)	0.51 (15)	0.36 (29)	0.14 (34)	0.19 (32)
RI	3.49 (14)	4.37 (9)	3.44 (12)	0 (38)	0.24 (22)	1.62 (18)	0.13 (35)	3.14 (15)
SC	16.58 (1)	15.29 (1)	16.22 (2)	11.5 (4)	0.41 (17)	3.55 (9)	19.29 (4)	18.61 (5)
SD			0.09 (36)	0 (38)			2.85 (13)	1.54 (19)
TN	5.25 (12)	1.43 (25)	1.02 (25)	1.42 (21)	0.6 (13)	8.64 (4)	0.57 (27)	0.22 (31)
TX				1.97 (18)				19.45 (4)
UT		0.99 (31)	0 (40)	0 (38)		0.99 (22)	1.48 (16)	4.58 (13)
VA	2.76 (17)	0.31 (36)	1.6 (20)	0.98 (29)	0.58 (14)	0.65 (23)	0.83 (22)	46.39 (2)
VT	14.29 (2)	5.47 (6)	2.06 (16)	0 (38)	0 (32)	2.99 (10)	1.03 (18)	1.62 (17)
WA	0.93 (31)	1.64 (22)	0.59 (30)	0.24 (36)	0.2 (26)	1.12 (21)	1.09 (17)	0.08 (37)
WI	1.36 (25)	1.83 (21)	0.82 (27)	0.48 (35)	0.42 (16)	0.05 (36)	0.33 (28)	0.06 (38)
WV	2.1 (18)	1.51 (23)	1.24 (22)	1.41 (22)	0.08 (28)	0.08 (34)	0.1 (36)	0.11 (35)
WY	10.9 (4)	3.55 (14)	4.61 (9)	7.69 (7)	0 (32)	0.33 (30)	2.01 (14)	12.96 (9)
μ	4.09	3.39	3.58	3.63	1.84	6.89	3.58	4.92
σ	4.21	3.32	4.92	5.93	4.86	20.5	6.04	10.9
n	36	37	41	43	36	37	41	43

Note: Rankings are in parentheses. No observations signifies states that did not have NPDES authorization in that year. Inspections include sampling inspections only. Enforcement actions include all informal and formal actions (excluding civil and criminal judicial referrals). The number of active facilities is the number of active NPDES permits. All data come from the EPA's Integrated Database for Enforcement Analysis database.

Table 3.4 Rankings of State Enforcement of the Resource Conservation and Recovery Act, 1987-2002

	Inspections per 100 Handlers				Enforcement Actions per 100 Handlers			
State	1987	1992	1997	2002	1987	1992	1997	2002
AL	53.2 (22)	130.7 (10)	250 (5)	85.1 (24)	33.3 (33)	105.5 (8)	149.7 (4)	63.1 (23)
AR	34.1 (33)	39.6 (32)	20.1 (43)	23.9 (45)	37.4 (29)	63 (18)	35.8 (30)	49.7 (28)
AZ	35.8 (32)	27.1 (41)	30.5 (38)	27.9 (43)	41.9 (24)	26.3 (37)	19.2 (42)	31.8 (38)
CA			4.9 (47)	7.3 (47)		18.9 ()	4.5 (47)	4.8 (46)
CO	115.8 (9)	134.1 (9)	76.2 (17)	211.6 (10)	46 (21)	56.6 (22)	66.5 (13)	52.7 (27)
CT		39.9 (31)	26 (40)	28.6 (42)		29.5 (36)	42.5 (27)	42 (35)
DE	20 (40)	65.4 (21)	134.3 (10)	61.2 (32)	12.7 (40)	43.1 (30)	58.6 (17)	25.4 (42)
FL	105.5 (11)	144.7 (8)	277.8 (4)	364.2 (3)	178.7 (2)	206.8 (4)	214.2 (2)	249.5 (1)
GA	55 (21)	76.9 (18)	70.4 (20)	123.8 (17)	53.9 (17)	48.6 (25)	44.3 (26)	97.1 (9)
IA							0 ()	49.4 ()
ID		59.8 (23)	60 (24)	262.9 (8)		225.6 (3)	65.5 (15)	197.1 (2)
IL	25.5 (38)	29.6 (39)	10.4 (45)	21.4 (46)	22.5 (37)	18.7 (41)	15 (45)	17.2 (45)
IN	26.4 (37)	36.9 (34)	75.5 (18)	159.9 (12)	37.3 (30)	33 (33)	51.6 (19)	145.9 (5)
KS	142.9 (7)	91 (15)	126.8 (12)	81.4 (25)	94.7 (6)	89.6 (10)	125.5 (6)	157 (4)
KY	72.4 (15)	145.4 (7)	53.7 (28)	179.2 (11)	47.4 (20)	269.8 (2)	94.1 (8)	83.3 (13)
LA	33.3 (34)	65.1 (22)	33.3 (37)	67.8 (29)	28.2 (34)	72.3 (12)	29.5 (36)	22.6 (43)
MA	57.6 (18)	104.5 (12)	57.4 (27)	60 (34)	49.4 (18)	59.5 (19)	75.3 (10)	69 (21)
MD	86.8 (14)	29.9 (38)	26.7 (39)	568.8 (1)	59.6 (13)	25.4 (38)	17.3 (43)	143.8 (6)
ME		12.1 (44)	12.5 (44)	39.7 (39)		14.2 (43)	23.8 (41)	75.3 (16)
MI	48.6 (25)	71.3 (19)	95.6 (16)	144 (13)	39.5 (25)	54.8 (23)	73.5 (11)	140.6 (7)
MN	52 (23)	109.3 (11)	47.7 (31)	56.2 (36)	56.9 (15)	150.7 (7)	45.3 (24)	74.6 (17)
MO	38.4 (31)	49.5 (27)	67.5 (22)	98 (21)	43.2 (23)	70.9 (13)	65.5 (14)	57.2 (26)
MS	48.5 (26)	29.6 (40)	44.5 (33)	63 (31)	69.1 (10)	46.8 (26)	30.1 (35)	43 (33)
MT	584.2 (1)	178.8 (3)	412.7 (2)	463.2 (2)	147.4 (4)	103 (9)	60 (16)	42.1 (34)
NC	88 (12)	147.5 (6)	127.9 (11)	122.2 (19)	38.4 (27)	83.6 (11)	40 (28)	47 (31)
ND	205.3 (5)	156.5 (5)	239.1 (6)	261.1 (9)	163.2 (3)	395.7 (1)	221.7 (1)	138.9 (8)
NE	87 (13)	34.1 (35)	38 (36)	122.6 (18)	107.8 (5)	53.5 (24)	31.6 (33)	64.3 (22)
NH	26.4 (36)	8.5 (45)	7.8 (46)	27.1 (44)	34 (31)	11 (45)	10.5 (46)	41 (36)
NJ	64.7 (16)	24.9 (42)	65.3 (23)	66.9 (30)	180.3 (1)	25 (39)	51.1 (20)	57.5 (25)
NM	48.9 (24)	93.3 (14)	118.5 (14)	115.2 (20)	48.9 (19)	63.8 (17)	44.4 (25)	95.7 (11)
NV	276.9 (3)	337.6 (1)	326 (3)	269.5 (7)	38.5 (26)	11.6 (44)	52.1 (18)	96.3 (10)
NY	41.3 (30)	30.2 (37)	23.3 (42)	43.1 (38)	33.8 (32)	17 (42)	17.2 (44)	25.6 (41)
OH		30.2 (36)	69.5 (21)	59.5 (35)		58.9 (20)	50 (22)	88.8 (12)
OK	45.5 (28)	44.3 (29)	40 (35)	70.3 (28)	24.7 (35)	42.5 (31)	31.4 (34)	49.3 (30)
OR	42.5 (29)	59.7 (24)	73.8 (19)	51.2 (37)	37.6 (28)	159 (6)	155.2 (3)	73.7 (18)
PA	107.9 (10)	82.5 (16)	138.1 (9)	131.9 (15)	85.9 (7)	38.6 (32)	26.8 (39)	18.8 (44)
RI	58.8 (17)	55.1 (25)	50 (30)	86.9 (23)	58.8 (14)	70.8 (14)	33.6 (32)	80.8 (15)
SC	46.3 (27)	97.8 (13)	103.6 (15)	141.9 (14)	21.7 (38)	43.7 (29)	24.5 (40)	31.4 (39)
SD	387.5 (2)	164.7 (4)	143.5 (8)	270.6 (6)	81.3 (8)	66.7 (16)	34.8 (31)	0 (47)
TN	230.4 (4)	67 (20)	58.5 (26)	76 (27)	59.8 (12)	46.4 (27)	77.8 (9)	72.6 (19)
TX	57 (19)	38.8 (33)	51 (29)	60.3 (33)	56.5 (16)	58.8 (21)	49.2 (23)	57.7 (24)
UT	31.5 (35)	51.4 (26)	24.8 (41)	39.6 (40)	23.9 (36)	70 (15)	29.4 (37)	30.2 (40)
VA	55.5 (20)	45.1 (28)	120.2 (13)	126.8 (16)	44.2 (22)	32.8 (35)	69.8 (12)	81.2 (14)
VT	116.5 (8)	77.4 (17)	47.1 (32)	32 (41)	78 (9)	45.2 (28)	50 (21)	72 (20)
WA	13 (41)	18.9 (43)	40.3 (34)	78.4 (26)	12.3 (41)	22.5 (40)	28.5 (38)	35.5 (37)
WI	23.1 (39)	42.4 (30)	58.5 (25)	88.4 (22)	13.3 (39)	32.9 (34)	38.9 (29)	49.7 (29)
WV	162 (6)	279.7 (2)	153.2 (7)	322 (4)	62 (11)	201.4 (5)	149.6 (5)	166.7 (3)
WY			435 (1)	313.6 (5)			115 (7)	45.5 (32)
μ	94.0	81.3	97.2	131.4	58.6	77.0	60.4	72.4
σ	109.1	67.1	99.4	72.4	42.2	76.5	49.1	51.4
n	41	45	47	47	41	45	47	47

Note: Rankings are in parentheses. No observations signifies states that did not have RCRA Subtitle C (base program) authorization in that year. Inspections include sampling inspections only. Enforcement actions include all informal and formal actions (excluding civil and criminal judicial referrals). Enforcement data come from the EPA's Integrated Database for Enforcement Analysis database. The number of handlers is the sum of the number of generators, transporters, and treatment, storage, and disposal facilities of hazardous waste. These data come from various years of the EPA's *National Biennial RCRA Hazardous Waste Report*. These data are not available annually, so missing years were imputed using linear interpolation.

Table 3.5 Correlations Among Measures of State Environmental Effort

	CAA Insp. (1)	CAA Enf. Actions (2)	CWA Insp. (3)	CWA Enf. Actions (4)	RCRA Insp. (5)	RCRA Enf. Actions (6)	Levinson Index (7)	Free Index (8)	Green Index (9)
CAA Insp.	1.0	.45	.06	.08	.18	.05	.01	-.27	.50
CAA Enf. Actions		1.0	.06	.16	.12	.07	.13	-.14	.20
CWA Insp.			1.0	.05	.07	-.12	.05	.09	-.04
CWA Enf. Actions				1.0	-.09	-.07	-.04	.06	.15
RCRA Insp.					1.0	.44	.02	-.31	.19
RCRA Enf. Actions						1.0	.16	-.20	.22
Levinson Index							1.0	-.21	.12
Free Index								1.0	.89
Green Index									1.0

Chapter 4. Is there Convergence in State Environmental Regulation?

Introduction

Theories of regulatory competition suggest that we should observe convergence in regulatory behavior across competing political jurisdictions. The race to the bottom argument in particular, predicts a specific pattern of convergence: interjurisdictional economic competition should push levels of environmental regulation down to the level of the least stringent jurisdiction. In the case of the U.S. states, therefore, an outcome indicative of a race to the bottom in environmental regulation would be one in which states, over time, relax the stringency of their environmental regulation to the level of the least stringent state. In this short chapter, I test the specific hypothesis that, if there is a race to the bottom in state environmental regulation, we should observe a convergence of state enforcement of federal pollution control programs down to the level of the least stringent state.

The balance of this chapter proceeds as follows. In section 4.1, I review the existing literature on policy convergence, and develop predictions about the pattern of convergence for the race to the bottom argument, as well as for the race to the top argument and for the no regulatory competition argument. In section 4.2, I discuss the tests I use to detect convergence and the results of these tests. Last, in section 4.3, I review the limitations of these results.

4.1 Policy Convergence Literature

Scholars have long been interested in the notion of policy convergence, particularly as it relates to comparative studies of public policy. Kerr (1983, p.3) offers a typical definition of convergence: "the tendency of societies to grow more alike, to develop similarities in structures, processes, and performances." The idea that convergence implies similarities in policy across societies, has led to a large comparative public policy literature that considers the correspondence of policy across countries.[1]

[1]There is considerable ambiguity as to what is meant by "policy." Bennett (1991) notes that what is

Most of the empirical literature on policy convergence involves one of two types of empirical inquiry.[2] First, scholars have used qualitative case studies to examine similarities across countries. These cross-national studies examine policies in diverse areas, including environmental regulation (Vogel, 1986; Brickman, et al. 1995; Badaracco, 1983), occupational safety and health (Kelman, 1981), and data privacy (Bennett, 1992). The second approach scholars have adopted is cross-national statistical studies that explore the empirical determinants of public policies, such as social policy (Overbye, 1994), fiscal policy (Olewiler, 1999), and environmental policy (Botcheva and Martin, 2001).

This literature suffers from a couple of shortcomings. First, too often "policy" is loosely defined and scholars are not studying functional equivalents. For example, what one country legislates, another might handle with administrative action (Brickman, et al. 1995; Bennett, 1991). This is a particular problem in the case study literature. Second, policy convergence suggests more than mere similarity. Convergence implies a temporal pattern in which policy across jurisdictions becomes more alike over some designated period of time (Seeliger, 1996; Bennett, 1991). In addition, policy convergence is often considered interchangeably with related phenomenon, such as policy transfer, policy diffusion, and policy learning (Heichel, et al. 2005). But, policy convergence as it relates to the race to the bottom theory suggests something more specific – a literal clustering of behavior at the level of the least stringent state. Therefore, when we consider the case of U.S. state environmental regulatory competition, theory predicts some specific patterns of convergence. With respect to the race to the bottom argument, we should observe a convergence of environmental protection effort to the level of the least stringent state. In this case, the primary pressure for convergence is economic – non-converging states face the risk of losing mobile capital to converging states (Drezner, 2001). As depicted in the top panel of Figure 4.1, we should see states reducing their regulatory effort over time until it is consistent with that put forth by the least stringent state. This convergence suggests two empirical predictions. First, there should be less

typically meant if one of five things: policy goals, policy content, policy instruments, policy outcomes, and policy style."

[2]Heichel et al. (2005) provide a comprehensive review of the convergence literature. They have an expansive view of what qualifies as convergence, which goes well beyond what we would expect to see in the regulatory competition context.

overall variation in state regulatory effort. Second, we should see a pattern of convergence downward.

Alternative notions of regulatory competition also predict particular patterns of convergence. The race to the top logic suggests that we should see an upward harmonization or convergence to the level of the highest performing state – that is, the state putting forth the most environmental regulatory effort. As shown in the middle panel of Figure 4.2, this suggests that states will emulate the state with the most stringent environmental protection, and we should over time see a convergence of regulatory to the level of the state with the most stringent environmental regulation.

Finally, if there is no regulatory competition (i.e., no race), there should not be an obvious pattern of convergence. While some states may still peg their environmental regulatory effort to other states, we should not observe an overall convergence of regulatory effort to the state with either the most or least stringent environmental regulation. This type of outcome is depicted in the bottom panel of Figure 4.3.

The existing empirical literature on U.S. environmental regulatory competition has not considered whether there has been convergence across the states. I consider the case for convergence in the next section.

4.2 Detecting Convergence in State Regulatory Enforcement

I use a couple of approaches to assess the degree of convergence in state regulatory effort, one statistical and one graphical. The statistical test examines the degree to which the variation in state regulatory effort across the country has declined over time. I do this by computing the coefficient of variation for the six measures of environmental enforcement I discussed in Chapter 3: inspections and punitive enforcement actions taken under the federal Clean Air Act (CAA), Clean Water Act (CWA), and Resource Conservation and Recovery Act (RCRA). While the coefficient of variation is informative for identifying whether there has been an overall convergence in state environmental regulatory effort, it is not helpful for determining the direction of this convergence. To address whether there is convergence to the lowest common denominator – as predicted by the race to the bottom theory – I consider

whether we observe states reducing their regulatory effort to the least stringent state, either on a national level or on a regional level. I explain how I do this below, but first I consider whether there has been an overall decline in amount of variation of state environmental enforcement across the country.

The coefficient of variation is a dimensionless measure of the deviation of a variable from its mean, and is defined as $c_v = \sigma/\mu$. A marked decrease in this deviation over time would be suggestive of convergence. Figure 4.2 graphs the coefficient of variation for state inspections and enforcement actions take under each of the federal pollution control programs.

Overall, there is some evidence of a decrease in the amount of variation across the states, although there is some difference across the six measures of state environmental effort. Considering first the inspections data presented in left panel of Figure 4.2, from the early years in the time-series to the more recent years, there does appear to be some convergence in the state inspections under the CAA. With respect to the CWA, the degree of variation seems to be growing over the last ten years or so of the time-series, while the level of variation in state RCRA inspections shows no clear trend.

Turning to the enforcement actions data, graphed in the right panel of Figure 4.2, the amount of cross-state variation in CWA enforcement actions declined markedly over the last ten years in the time-series. There is also a modest downward trend through the time-series in the amount of variation of enforcement actions taken by states under the CAA. The variation in state enforcement of the RCRA, however, remained relatively stable throughout the period.

Collectively, therefore, there is some evidence of a decline of the degree of variation in state enforcement effort, which might suggest that there has been some convergence in state environmental regulatory behavior, at least as measured by environmental enforcement data. This convergence may be indicative of a race to the bottom or a race to the top in state environmental regulatory practices, or at least of a clustering of enforcement at a similar level. It is also possible, that this convergence represents a successful effort by the federal Environmental Protection Agency (EPA) to get states to adopt similar approaches to enforcement, although this seems unlikely given the evidence presented in Chapter 3

regarding the inconsistency (temporally and geographically) of EPA oversight.

Evidence of convergence alone, however, is insufficient to draw inferences about whether regulatory competition produces such an outcome because we cannot conclude solely from these analyses whether this convergence is moving enforcement efforts to the level of the least stringent state, the most stringent state, or to some other state (e.g., the median performer). One way to do this is to graph states regulatory effort to see if there is any visual evidence of convergence. If regulatory competition has led to a race to the bottom in state environmental enforcement effort, we should, over time, observe an increased clustering of enforcement around the level of this least stringent state.

In Figures 4.3 through 4.5, I have graphed each state's enforcement of the CAA, CWA, and RCRA – using both the inspections and punitive enforcement actions measures – in terms of its deviation from the state that conducted the least enforcement during the 1985 to 2002 period.[3] As discussed in Chapter 3, 1985 is not an arbitrary starting point, but one I selected for several reasons. In 1984, the EPA for the first time implemented a policy framework that attempted to bring more uniformity to state enforcement of federal pollution control programs, which prior to that point had been largely ad hoc (Rechtschaffen and Markell, 2003; Mintz, 1995). Second, in the early years of the CAA, CWA, RCRA, and other pollution control programs, the EPA did not encourage states use many of the enforcement tools in its arsenal (Mintz, 1995). Last, data quality from the 1970s through the first half of the 1980s has some obvious inconsistencies.

Comparing across the three pollution control programs, there seems to be more concentration of state enforcement effort near the level of the state performing the fewest enforcement actions in the case of the CWA (Figure 4.4). The state performing the fewest CWA inspections was New Mexico, while the state conducting the fewest punitive enforcement actions was Kansas. In each case, there is evidence of a clustering of enforcement at these states' low levels, although there does not appear to be an obvious increase in this clustering over time, which is what race to the bottom theory predicts. There is considerably less clustering – and no strong evidence of convergence over time – with respect to state enforcement of the

[3]Determined as the state that performed the least enforcement on average between 1985 to 2002.

CAA and the RCRA, as shown in Figures 4.3 and 4.5, respectively.

Considering all of the states together may be problematic. In particular, looking for national convergence may mask a pattern of regional convergence – that is, convergence of environmental regulatory effort within regions consisting of states that are thought to compete for economic investment. To examine this possibility, I search for convergence on a regional basis, using the Bureau of Economic Analysis (BEA)'s economic region classification system to define competitor states.[4] The BEA divides the United States into eight separate regions: New England, Mideast, Great Lakes, Plains, Southeast, Southwest, Rocky Mountain, and Far West.[5] For succinctness, I only present the graphs for state inspections taken to enforce the three federal pollution control programs.[6]

Figures 4.6 and 4.7 are inspections taken under the CAA, presented by BEA region. In each figure, the horizontal line represents the level of enforcement put forth by the state performing the least amount of enforcement on average during the period, and each other states enforcement is graphed in terms of its deviation from this state. Across the eight BEA regions, there is not much evidence of convergence. In fact, not only does there not appear to be substantial convergence at the level of the state performing the least number – as the race to the bottom theory predicts – there does not appear to be much convergence at all. The exceptions are the Southeast region, where states seem to be moving their levels of enforcement effort in concert, and the Rocky Mountain region where, since about 1995, there has a been a convergence.

I present the analogous graphs for state enforcement of the federal CWA in Figures 4.8 and 4.9. Here, there seems to be a little more evidence of convergence. In each of the regions, with the exceptions of the Rocky Mountain and Far West (and to a lesser extent the Great

[4]As I discuss in more detail in Chapter 5, there is not an accepted convention in the literature for defining states' economic competitors. For this reason, later in the dissertation I consider multiple definitions.

[5]The states in each region are as follows: New England (Connecticut, New Hampshire, Maine, Massachusetts, Rhode Island, and Vermont), Mideast (Delaware, Maryland, New Jersey, New York, and Pennsylvania), Great Lakes (Illinois, Indiana, Michigan, Ohio, and Wisconsin), Plains (Iowa, Kansas, Missouri, Minnesota, Nebraska, North Dakota, South Dakota), Southeast (Alabama, Arkansas, Florida, Georgia, Kentucky, Louisiana, Mississippi, North Carolina, South Carolina, Tennessee, Virginia, West Virginia), Southwest (Arizona, New Mexico, Oklahoma, and Texas), Rocky Mountain (Colorado, Idaho, Montana, Utah, and Wyoming), and Far West (California, Nevada, Oregon, and Washington).

[6]Analogous graphs for the punitive actions dependent variable look fairly similar.

Lakes region), there is a clustering of state enforcement efforts near the level of the state performing on average the least number of inspections (per facility) in the region. Moreover, in several of the regions, there seems to be convergence over time, particularly in the New England, the Southeast, the Plains, and the Southwest regions.

Last, consider the case for convergence with respect to state enforcement of the RCRA, presented in Figures 4.10 and 4.11. The best evidence of a pattern of convergence consistent with the race to the bottom argument comes in the Mideast and the Plains regions. Otherwise, there does not appear to be much clustering around the level of the state conducting the least enforcement.

4.3 Conclusion

In sum, the evidence for convergence is modest at best. Across the six different measures of state-level environmental enforcement, there is some evidence that states efforts are at about the same level, although there is not much evidence that the degree of clustering increased over the 1985 to 2002 period. These tests, however, are crude, so it would be a mistake to infer too much. Moreover, convergence alone is only one empirical implication of regulatory competition theory in general, and the race to the bottom argument specifically. In particular, the race to the bottom argument suggests that states respond to the regulatory behavior of economic competitor states. I turn to this prediction in the next chapter.

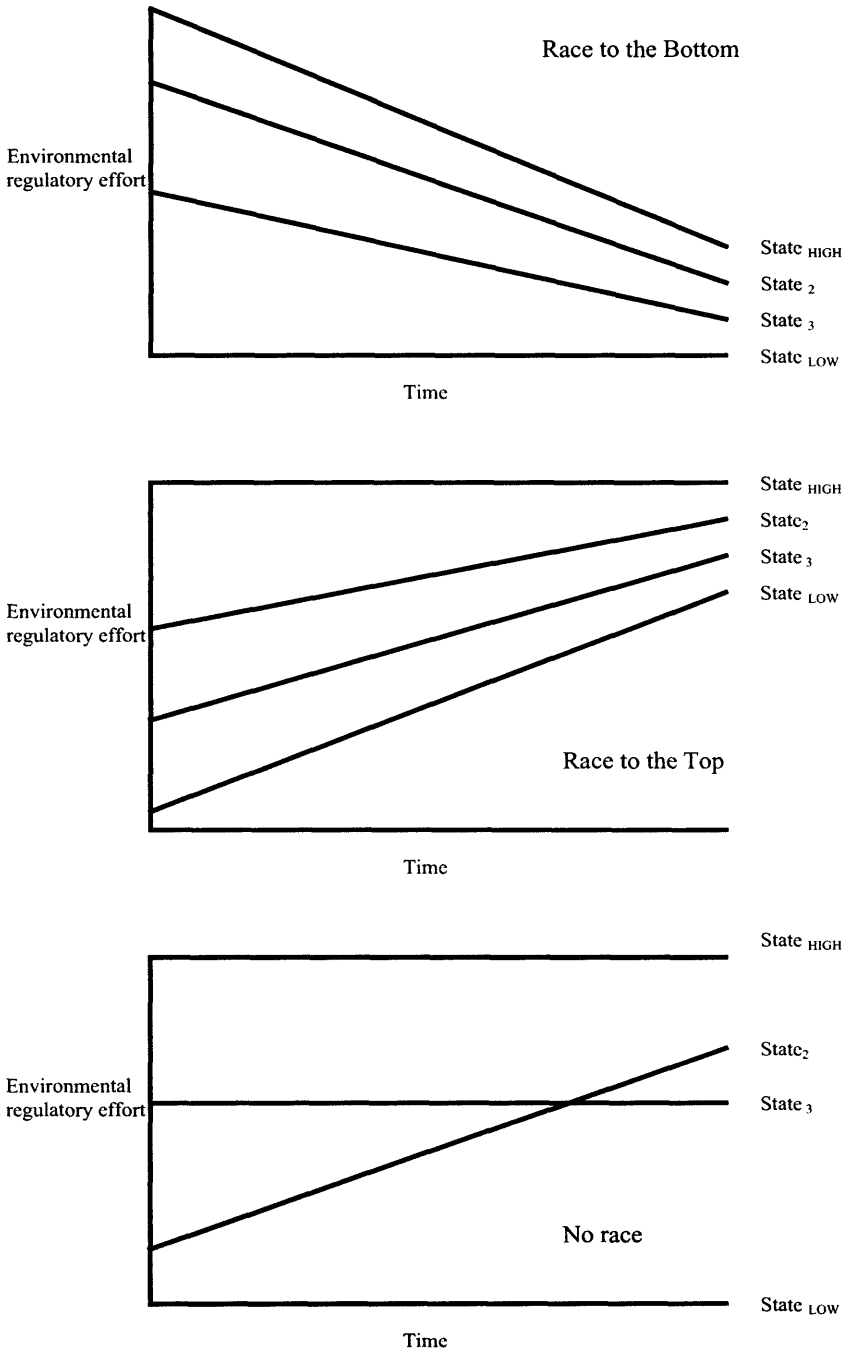

Figure 4.1: Schematics of Patterns of Convergence

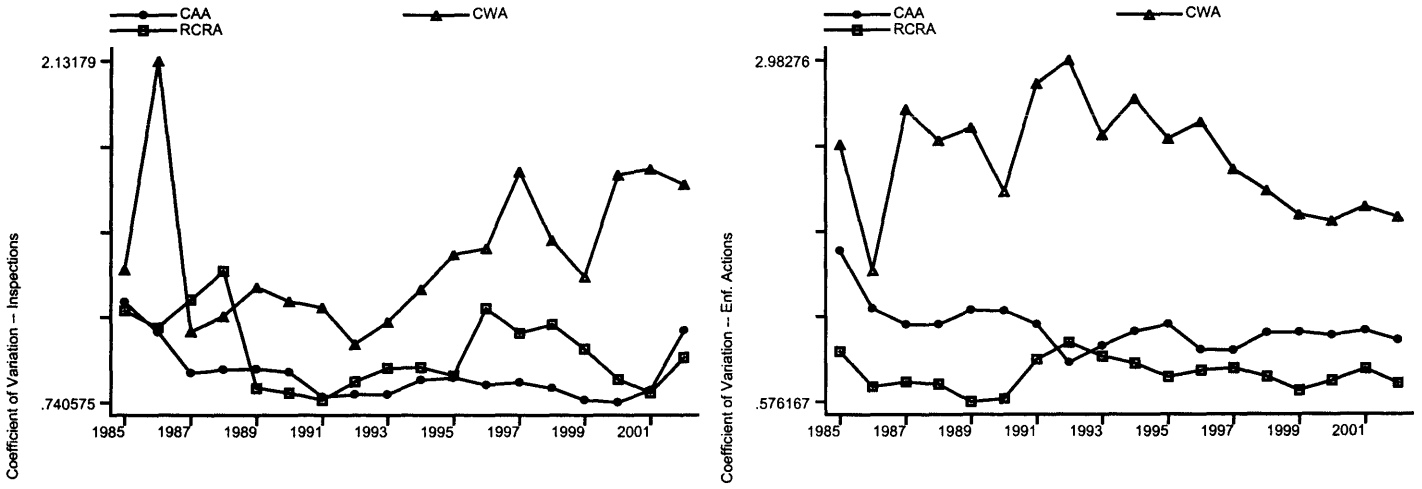

Figure 4.2: Coefficients of Variation for Six Measures of Environmental Enforcement

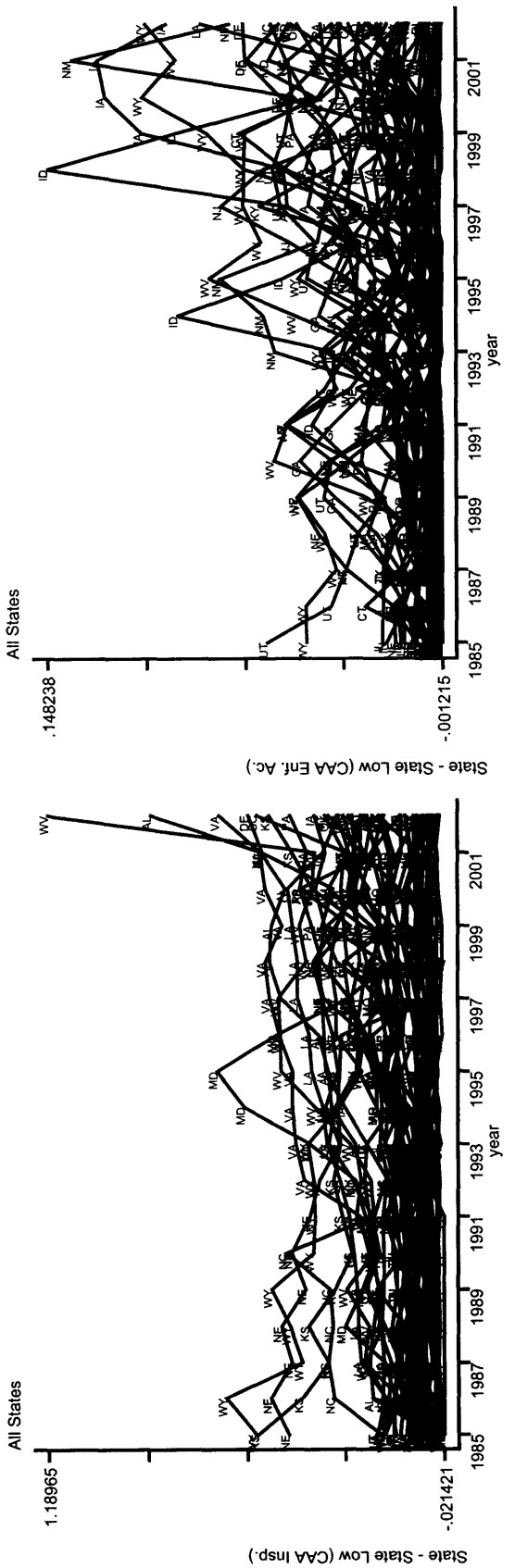

Figure 4.3: Convergence in State Enforcement Effort – Clean Air Act, 1985-2002

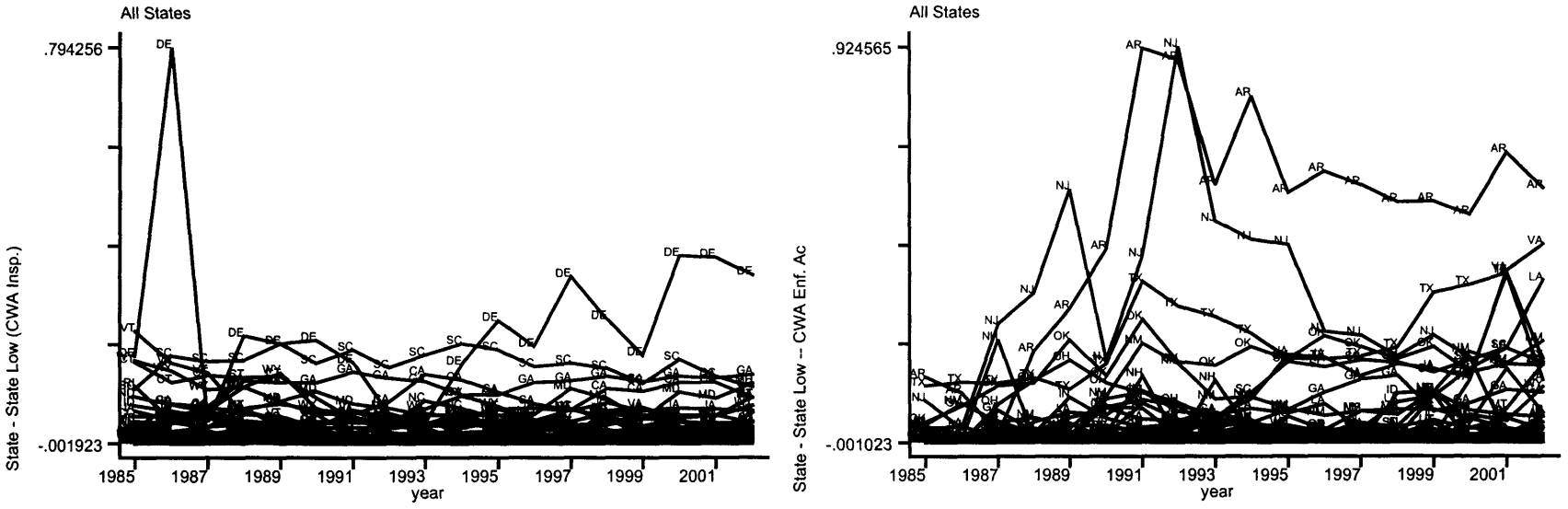

Figure 4.4: Convergence in State Enforcement Effort – Clean Water Act, 1985-2002

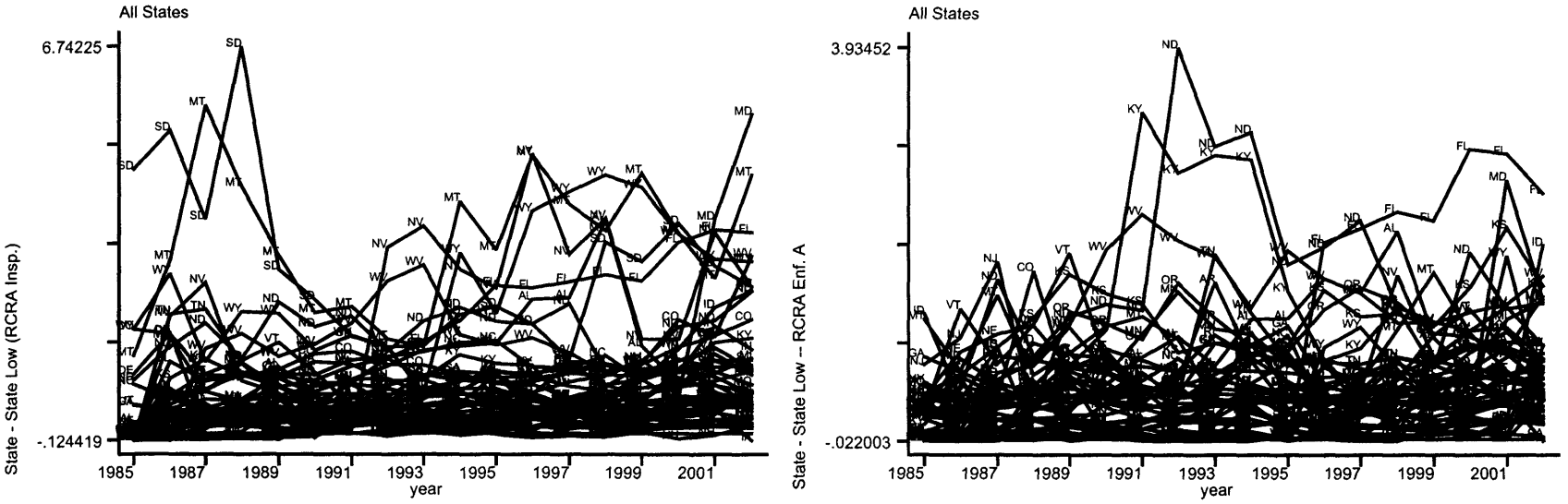

Figure 4.5: Convergence in State Enforcement Effort – Resource Conservation and Recovery Act, 1985-2002

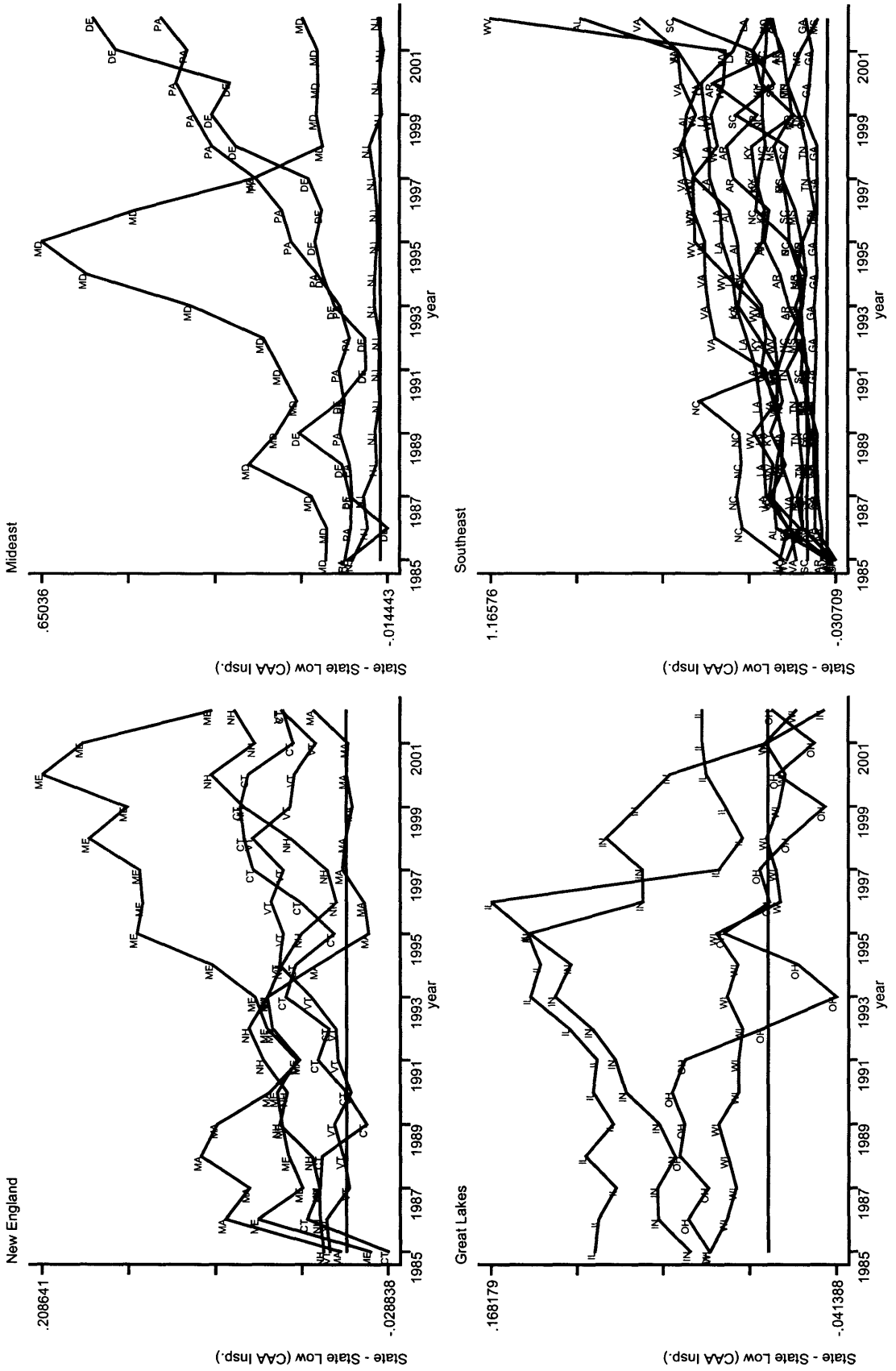

Figure 4.6: Convergence in State Enforcement Effort, by BEA Region – Clean Air Act, 1985-2002. Note: Measured as deviation from Rhode Island for New England region, New York for Mideast region, Michigan for Great Lakes region, and Florida for Southeast region.

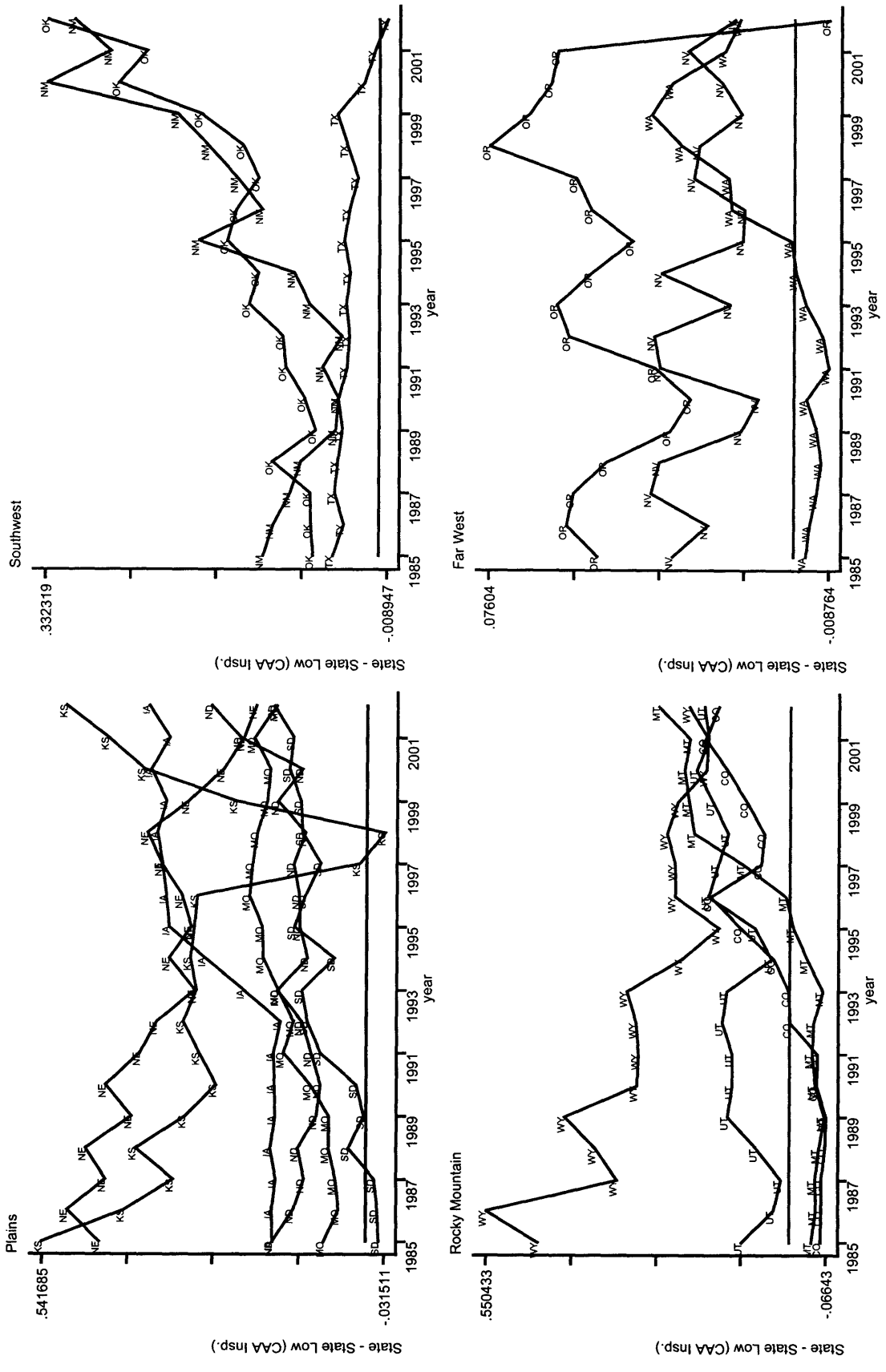

Figure 4.7: Convergence in State Enforcement Effort, by BEA Region – Clean Air Act, 1985-2002. Note: Measured as deviation from Minnesota for Plains region, Arizona for Southwest region, Idaho for Rocky Mountain region, and California for Far West region.

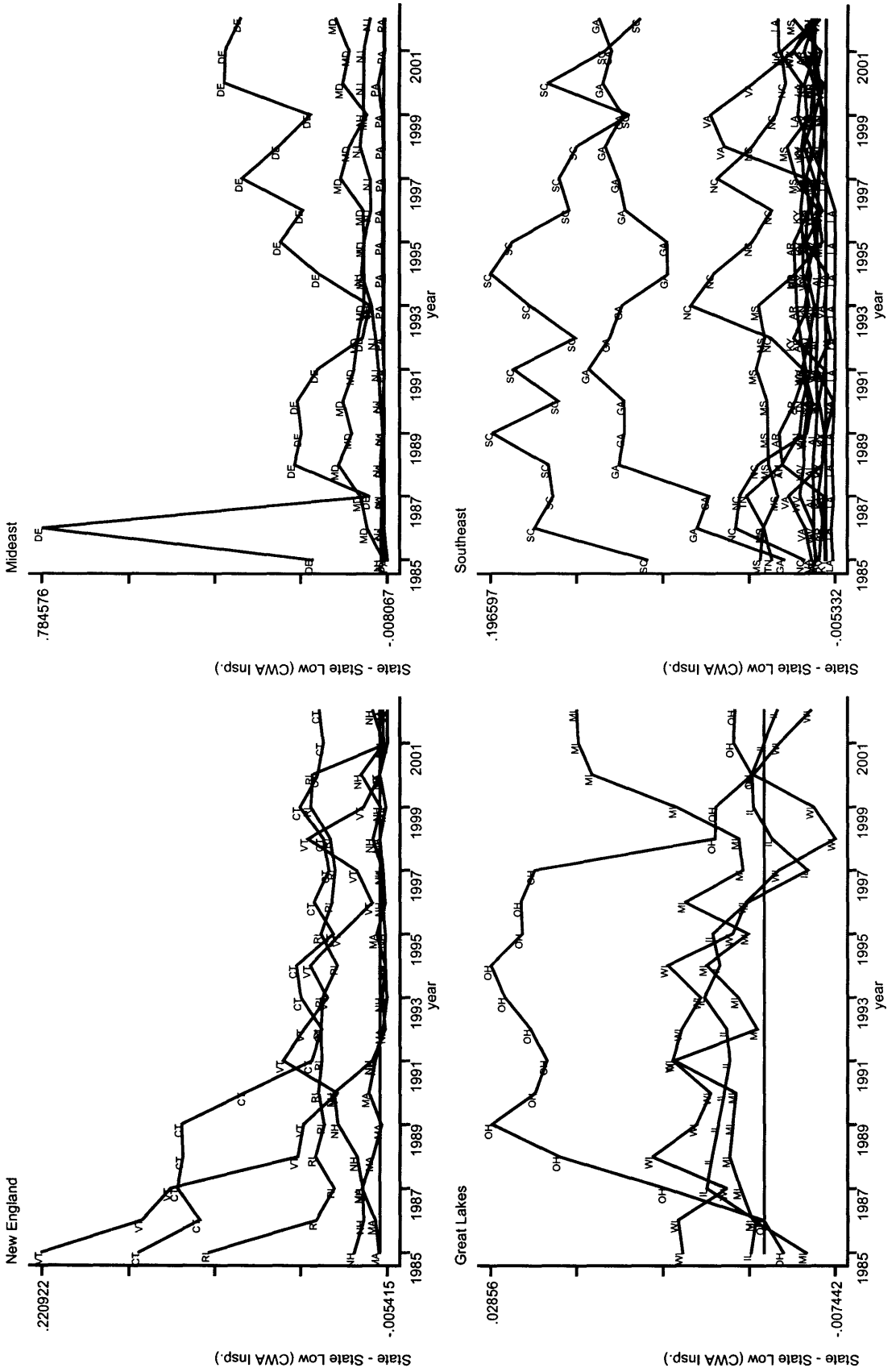

Figure 4.8: Convergence in State Enforcement Effort, by BEA Region – Clean Water Act, 1985-2002. Note: Measured as deviation from Maine for New England region, New York for Mideast region, Indiana for Great Lakes region, and Florida for Southeast region.

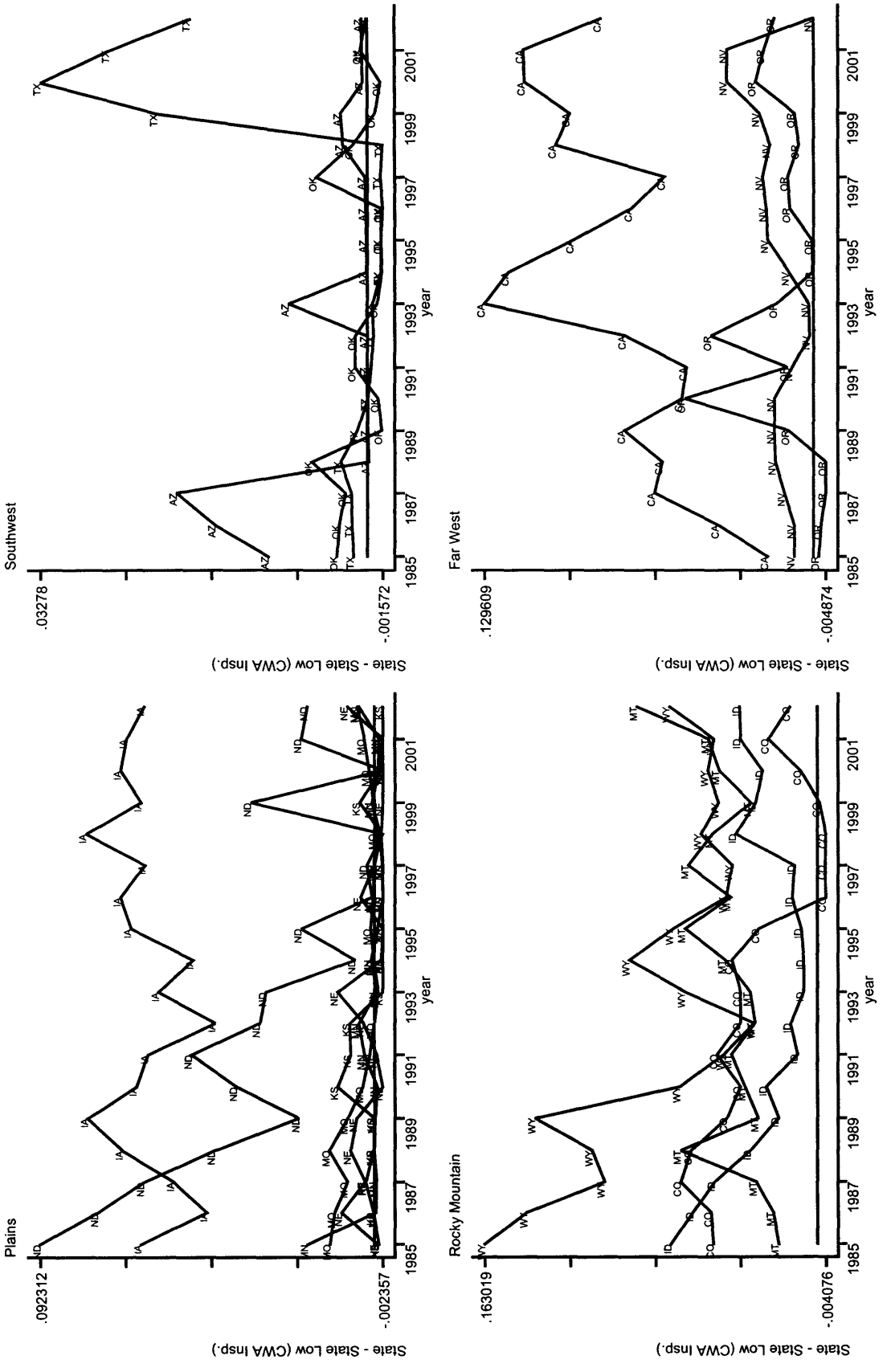

Figure 4.9: Convergence in State Enforcement Effort, by BEA Region – Clean Water Act, 1985-2002. Note: Measured as deviation from South Dakota for Plains region, New Mexico for Southwest region, Utah for Rocky Mountain region, and Washington for Far West region.

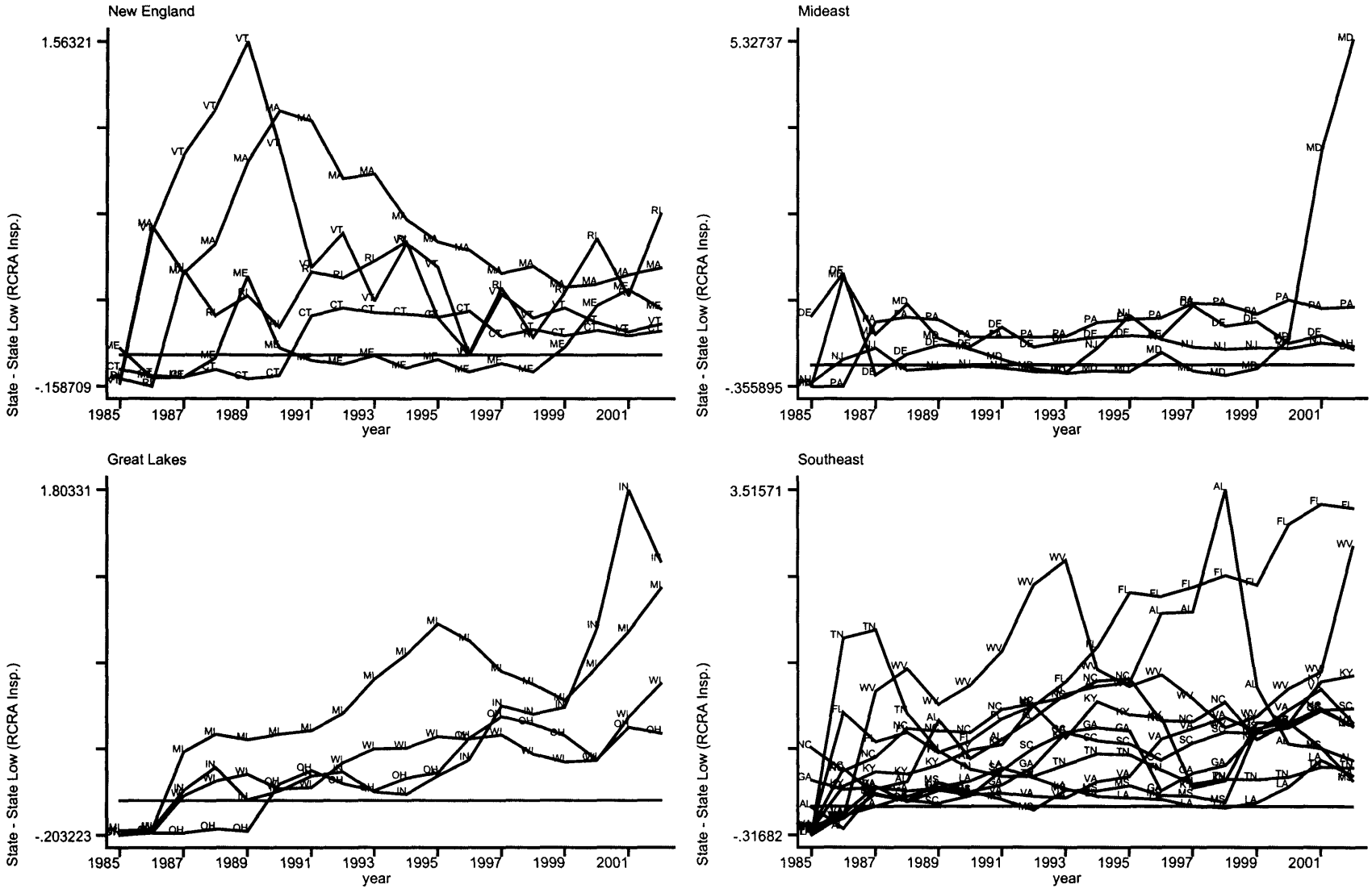

Figure 4.10: Convergence in State Enforcement Effort, by BEA Region – Resource Conservation and Recovery Act, 1985-2002. Note: Measured as deviation from New Hampshire for New England region, New York for Mideast region, Illinois for Great Lakes region, and Arkansas for Southeast region.

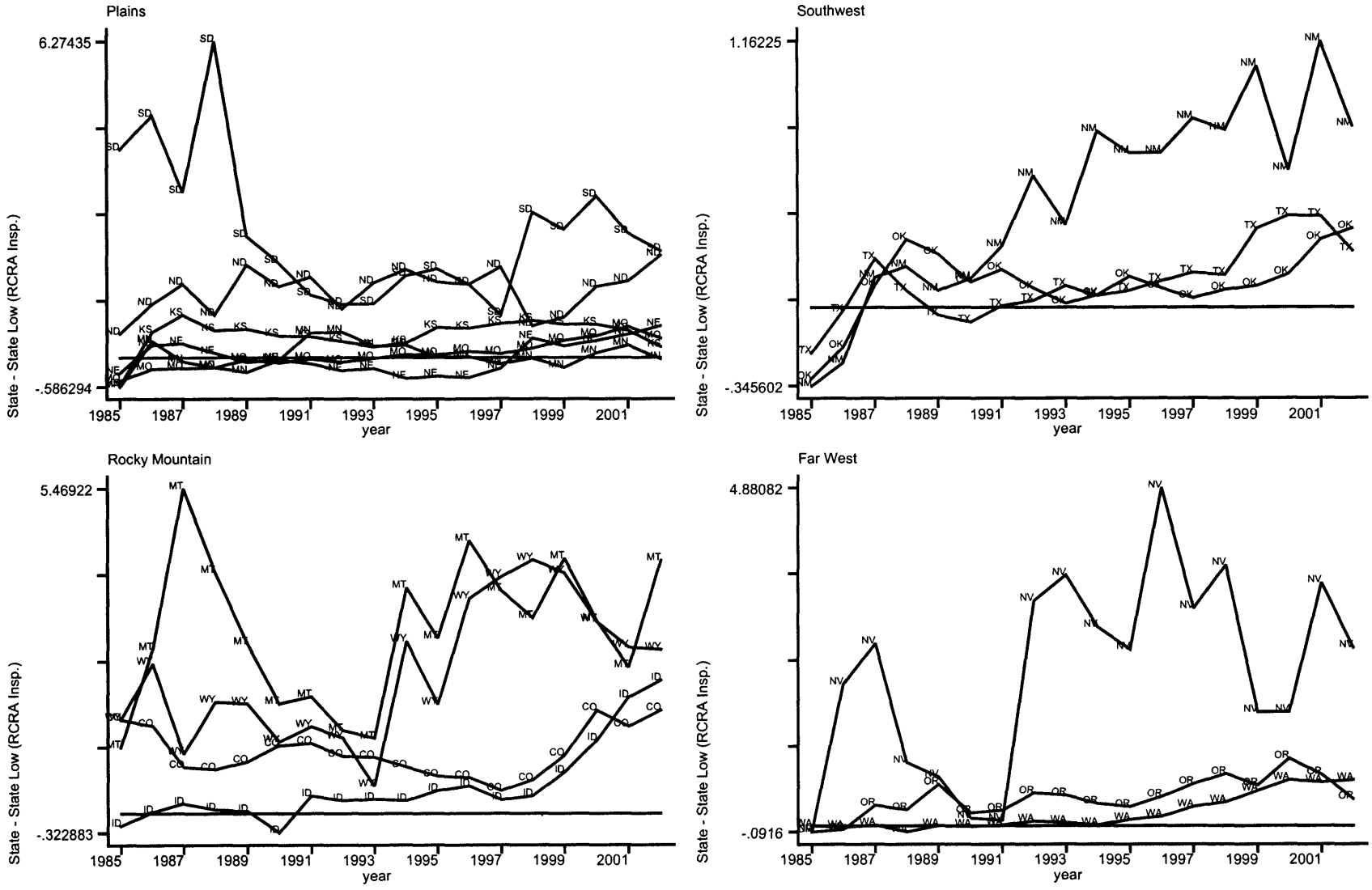

Figure 4.11: Convergence in State Enforcement Effort, by BEA Region – Resource Conservation and Recovery Act, 1985-2002. Note: Measured as deviation from Iowa for Plains region, Arizona for Southwest region, Utah for Rocky Mountain region, and California for Far West region.

Chapter 5. Strategic Interaction in State Environmental Regulatory Behavior

Introduction

Regulatory competition among governments suggests that state regulatory behavior is interdependent. While this assumption is fundamental to the race to the bottom (and the race to the top) theory, it has received scant attention in empirical studies. Instead, most of the studies purporting to the test race to the bottom theory have considered whether firm economic investment decisions are sensitive to interjurisdictional differences in the stringency of environmental regulation. While these studies inform our understanding of the efficacy of a strategy to use environmental regulation as a competitive instrument, they do not address the more fundamental question of whether state regulatory decisions respond to regulatory decisions in other states. Absent such evidence, there is not much reason to be believe that states use their environmental regulation as competitive instruments.

The federal government's assertion of authority in environmental policy in the 1970s was deliberately intended to eliminate the effects that interstate economic competition was thought to have on the willingness of state governments to impose environmental regulatory costs on the private sector. However, the major environmental legislation of this period, did not entail the wholesale rescinding of states' environmental protection responsibilities. Instead, Congress created a system based on a model of regulatory federalism, in which responsibility for providing environmental protection is shared by multiple levels of governments.[1] While the federal government (i.e., the EPA) is generally responsible for setting national standards, the details of implementation and enforcement are left largely to state environmental agencies. This regulatory federalism system provides state governments with considerable discretion in their enforcement of federal regulation, creating the opportunity for states to use their enforcement effort (or lack thereof) as a competitive instrument vis-à-vis other states. As states continue to aggressively pursue economic development, whether or not they engage in regulatory competition – and its potential implications for environmental

[1] More generally, this type of arrangement is often referred as cooperative federalism.

protection – is an important question to study.

Do states behave this way? If so, how can we detect such behavior? I directly examine these questions in this chapter. Using data on state enforcement of three federal pollution control programs – the Clean Air Act (CAA), the Clean Water Act (CWA), and the Resource Conservation and Recovery Act (RCRA) – I estimate a series of strategic interaction models designed to test for the presence of interdependence in states' environmental regulatory behavior. If states engage in regulatory competition, we should observe them responding to changes in the regulatory effort of the states with which they compete for economic investment. Strategic interaction models test for this relationship. First, I consider a baseline model which enables comparison to the few similar studies in the existing literature. Second, I estimate a more complete model that controls for intrastate political and economic factors also likely to affect states' environmental regulatory behavior. I subsequently test for asymmetric relationships. The idea that interstate economic competition will lead states to reduce their environmental enforcement effort is fundamental to the race to the bottom argument, and implies that there is a specific pattern of strategic interaction. Namely, we should expect states to respond to competitor states' regulatory behavior only when it places them at a disadvantage for attracting economic investment. Finally, I consider an alternative specification which allow for time lags in the pattern of states responsiveness.

The results of my analyses suggest strong evidence that states are engaged in strategic interaction. These findings are consistent with the hypothesis that state environmental enforcement behavior is influenced by competition from other states. I find elasticities in the range of about .5 to 1.5 which suggests that states respond to a 10% increase (decrease) in their competitor states' enforcement efforts with a 5% to 15% increase (decrease) in their own enforcement efforts. These results are robust to various definitions of competitor states and various weighting schemes, and state responsiveness occurs within the same year, as I do not find evidence of much strategic interaction in the time lag models. The evidence regarding the asymmetric effects is less compelling. While I find strong support for the idea that states respond to their competitors when their regulatory behavior puts them at a disadvantage, I also find evidence that states respond to their competitors when their regulatory enforcement

puts them at an advantage. So, while there is some evidence supportive of the race to the bottom argument, there is also some evidence support of a race to the top. I examine possible explanations for this finding in the concluding section.

This chapter proceeds as follows. In section 5.1, I review the existing literature on strategic interaction of state government behavior. Next, in section 5.2, I present the strategic interaction models I estimate, including models explicitly specified to test for the asymmetric pattern suggested by the race to the bottom argument. I report the results of these models in section 5.3. Last, in section 5.4 I discuss the implications of the results, and outline the next steps in the analysis.

5.1 Review of Literature

There is a small, but growing literature that examines whether there is strategic interaction in state governmental behavior.[2] The possibility that interstate economic competition influences state policy choices pertains to areas other than environmental regulation. The closest analog is state fiscal policy. Scholars have argued that competition for mobile capital may lead state governments to manage their tax rates in such a way as to create (or, at least attempt to create) a competitive advantage relative to other states (Phillips, 2004; Hernández-Murillo, 2003; Altshuler and Goodspeed, 2002; Brueckner and Saavedra, 2001). The competition mechanism is also strong in the context of state provision of welfare benefits. Differentials in state welfare benefits, if large enough, may lead to a migration of welfare recipients from low-benefit states to high-benefit states. To the degree that states do not want to attract new welfare recipients, they may modify their welfare benefits such that they are less generous than their neighbors (e.g., Bailey and Rom, 2004; Berry, et al. 2003; Saavedra, 2000; Figlio, et al. 1999, Rom, et al. 1998). Scholars have also examined strategic interaction among states in the areas of state expenditures (Case, et al., 1993) and education (e.g., Rom and Bailey, 2005; Millimet and Collier, 2004).

There are only a few empirical studies that directly test for strategic interaction in

[2]In some ways, this literature is related to work on policy diffusion among the states, which also models the effects of interstate influences on state policy choices (e.g., Walker, 1969; Berry and Berry, 1990; Gray, 1997).

U.S. state environmental regulation. Fredriksson and Millimet (2002b) argue that states do take into account their competitor states' regulatory behavior when determining their own environmental protection effort. They study two proxy measures of state environmental regulation – state-level pollution abatement and control expenditures (PACE) per unit of manufacturing and an index of state environmental regulatory stringency developed by Levinson (2001) – each of which is derived from firm-level survey data compiled by the U.S. Census Bureau.[3] Levinson's index adjusts the PACE data to correct for variation in the industrial composition of states.[4] Using these data, Fredriksson and Millimet find a positive relationship between the environmental abatement costs incurred by manufacturing industries in competitor states. In particular, they find that these interactions occur within a two-year window for contiguous neighbors and within a five-year window for more distant states. They also find an asymmetric pattern of responsiveness – states react to changes in abatement costs in competitor states that have initially more stringent environmental policy, but not to states with initially less stringent environmental policy. This result contradicts the race to the bottom argument.

Levinson (2003) extends Fredriksson and Millimet's analysis by examining whether regulatory competition became more severe during the Reagan Administration, testing the hypothesis that competition should be more intense during periods of greater state control of environmental policy. As part of its New Federalism initiative, the Reagan Administration attempted to transfer authority in environmental policy from the federal government to state governments, mostly through cuts in state grants and various administrative reforms. Levinson uses his industry-adjusted index of PACE data and replicates Fredriksson and Millimet's basic finding regarding states responsiveness to changes in the abatement costs of neighboring states, but he does not find convincing evidence that competition steepened after the Reagan took office. Levinson also tests for regulatory competition in hazardous waste disposal taxes, again finding evidence suggestive of the idea that states' regulatory

[3]The Census Bureau collected these data annually as part of its Current Industrial Reports: Pollution Abatement Costs and Expenditures (PACE) series from 1977 through 1994 (excluding 1987), and again in 1998.

[4]Levinson's industry-adjusted index is ratio of actual pollution abatement costs in a stat to a prediction of the pollution abatement costs of the state, where the latter is estimated according to national abatement expenditures by industry and the industrial composition of the state.

decisions are interdependent.

A third paper considers competition in the context of multiple instruments. Fredriksson, et al. (2004) consider the possibility that states competing for mobile capital act strategically when determining three interrelated policies – environmental regulation, taxation, and infrastructure investment. They find evidence that states respond both within and across policy domains, which suggests that unidimensional studies may provide lower bound estimates of the level of strategic interaction.

Collectively, these papers provide some evidence supportive of the notion that states engage in regulatory competition in environmental regulation, although the findings in Fredriksson and Millimet (2002b) raise doubt about the empirical validity of the race to the bottom argument. However, the measures of environmental regulation used in the aforementioned papers are not ideal for testing the regulatory competition hypothesis. Regulatory competition models predict that state regulatory behavior responds to the behavior of other states with which it competes for economic investment. To appropriately test these theories, therefore, we need good measures of *actual* state regulatory behavior, and preferably measures of behavior that significantly affect the costs of doing business in different states.

With the exception of Levinson's analysis of hazardous waste disposal taxes, the studies summarized above measure environmental regulation using total state pollution abatement costs data.[5] However, these costs data do not reflect actual levers state regulators can use to modify their environmental effort. State-level aggregation of pollution abatement and control expenditures is the result of an unknown mix of the stringency of regulatory standards and implementation and enforcement practices. For example, two states could have virtually identical laws on the books, but, due to different approaches to implementation and enforcement, compare quite differently in terms of the pollution abatement costs data.

In addition, these studies do not directly control for state-level political and economic phenomena that too might influence state regulatory behavior. Although the statistical models do typically include state fixed effects, estimating separate state intercepts only

[5]In a recent paper, Woods (2006a) uses enforcement data to study the race to the bottom hypothesis, but he does not explicitly model the strategic interaction between states. I discuss his model later in this chapter.

captures state-specific factors that do not vary over time. As I discuss below, there are various intrastate factors that vary temporally that theoretically should help predict state environmental enforcement effort that should also be controlled for in statistical analyses of state regulatory enforcement.

As I argued in Chapter 3, I believe the enforcement effort put forth by state environmental agencies is a good measure of a states' regulatory climate. Recall, under regulatory federalism, many pollution control standards are uniform across the country – including many of those comprising central parts of the three federal programs studied here: the CAA, the CWA, and the RCRA. Unlike the pollution abatement costs data, state enforcement actions reflect regulatory behavior that states directly control and can modify in short order. Moreover, environmental enforcement effort can plausibly be used by states as a competitive instrument to attract economic investment, and there is considerable anecdotal and now survey evidence (discussed in Chapter 7) to suggest that states are concerned about the effect that environmental regulation has on business investment decisions. Last, since I study state enforcement of federal pollution control programs, differences in state enforcement are meaningful since the basic institutional structure of the programs are consistent across the country.

5.2 Strategic Interaction Models

To test for the presence of competition among states in environmental regulatory behavior, I estimate a series of strategic interaction models, also referred to as spatial lag models. This statistical approach models a state's chosen policy or behavior as a function of other states' policies or behaviors.[6] Social scientists have used these models to test for strategic interaction in state policymaking in numerous areas, including expenditures (Case, et al., 1993), taxation (e.g., Phillips, 2004; Hernández-Murillo, 2003; Altshuler and Goodspeed, 2002; Brueckner and Saavedra, 2001; Besley and Case, 1995), welfare benefits (e.g., Saavedra, 2000; Figlio, et al., 1999), and education (e.g., Millimet and Collier, 2004). As noted above, a few papers have estimated these models in the context of state environmental regulation (Fredriksson, et al. 2004; Levinson, 2003; Fredriksson and Millimet, 2002b).

[6]Brueckner (2003) provides a good review of empirical applications of strategic interaction models.

The basic specification is as follows:

$$E_{it} = \delta \sum_{j=1}^{48} \omega_{ijt} E_{jt} + \beta X_{it} + s_i + y_t + \epsilon_{it}, \qquad i = 1, ..., 48, j \neq i \tag{1}$$

where E_{it} is a measure of environmental regulatory effort in state i at time t, ω_{ijt} is a weight assigned to state j by state i at time t, E_{jt} is a measure of environmental regulatory effort in state j at time t, X_{it} is a vector of state characteristics, s_i are state fixed effects, y_t are year fixed effects, and ϵ_{it} are errors uncorrelated over time, but potentially correlated across states. The variable of primary interest in this model is the strategic interaction or spatial lag term, $\sum \omega_{ijt} E_{jt}$. This term represents a weighted average of competitors' environmental enforcement effort (using the same enforcement data used for the dependent variables). I discuss the definition and weights of competitors further below.

Detecting the presence of strategic interaction of government behavior among states requires testing for the significance of δ, where a nonzero coefficient suggests that one state's environmental regulatory effort is a function of other states' environmental regulatory efforts. In essence, the model suggests that there is a spatial correlation in state environmental regulatory behavior. The expectation is that δ will be positive – that is, that the environmental effort among competitor states moves in the same direction. While a statistically significant, negative coefficient on the spatial lag term would imply that there is strategic interaction among states, the interdependence would not reflect the type of competition suggested by regulatory competition theories. The null hypothesis is that there is no effect, in which case there simply is no regulatory competition.

The dependent variable in these analyses, E, is state enforcement of federal air, water, and hazardous waste pollution control regulation. Specifically, I consider the inspections measure and the more general enforcement effort measure described in Chapter 3. The first measure is the annual number of sampling inspections taken by state governments divided by the number (or an estimate of the number) of regulated facilities under the CAA, the CWA, and the RCRA. The second measure is the unweighted sum of informal and formal enforcement actions, again standardized by the total number of regulated facilities, taken by state environmental agencies in a given year. I consider these dependent variables over the

1985-2000 time period, and the unit of analysis therefore is a state-year. In the case of the CWA and the RCRA, I only include state-year observations for years in which the EPA had authorized the state to administer the programs,[7] which means a sample of 609 for state enforcement of the CWA and 672 for state enforcement of the RCRA.[8]

5.2.1 Control Variables

A state's response to interstate economic competition, of course, is not the sole determinant of state regulatory effort. Rather, each state has its own set of preferences and attitudes toward regulatory matters, or what some have termed "regulatory style" (Harrison and Antweiler, 2004; Gormley, 1998; Hunter and Waterman, 1996; Hutter, 1989). These preferences and attitudes are likely a function of state political economy, and, absent the influence of interstate economic competition, form the basis for choices about environmental regulatory enforcement. There are a number of empirical studies in the regulatory federalism and state politics and policy literature that explores the empirical determinants of state environmental policy in general, and regulatory enforcement effort in particular. Unfortunately, this literature has generated few consistent results, which makes it difficult to determine the correct set of control variables. For example, some studies find evidence supportive of interest group influences on state behavior, whereas others do not. Similarly, some studies find indication that the partisanship of state elected officials matters, while others find no such relationship. The inconsistency may, in part, be due to differences in the measurement of variables. Nevertheless, there is enough evidence to merit consideration of intrastate factors. In terms of equation (1), I include several control variables in the X_{it} vector of state characteristics.

First, one might think that the party affiliation of state elected officials will affect a state's approach to environmental enforcement. As I argued in Chapter 2, state elected officials – acting to either enhance their electoral prospects or at the behest of business lobbies – may attempt to shape the enforcement efforts of state regulators. Although all state elected officials

[7]More specifically, I consider state authorization in the year after EPA granted it to control for the fact that some states were granted authorization mid-year.

[8]By 1985, all states had had their State Implementation Plans approved by the EPA, so I included each state in the sample (768).

– irrespective of political party – are likely motivated in their policy choices by concerns for economic development, past research has shown a significant difference in the environmental policy preferences of Democrats and Republicans, with the former demonstrating a clearly more pro-environmental protection record than the latter. This difference is pronounced at the federal level, where representatives of the two major parties have distinct voting patterns on environmental issues (Shipan and Lowry, 2001; Ansolabehere, et al. 2001; Kamieniecki, 1995). At the state level, the evidence is more ambiguous but some studies have found that partisan control of governors' offices and state legislatures influence decisions about state environmental expenditures (Feiock and Stream, 1998) and regulatory behavior (Helland, 1998a; Wood, 1991). I use two variables to control for partisan differences.[9] First, I include a variable that measures the party affiliation of the governor (a dummy variable coded 1 if the governor is a Democrat and 0 if the governor is a Republican). Second, I consider the partisan composition of the state legislature, specifically, the percentage of representatives in both chambers that are Democrats.[10]

Of course, partisanship is not a perfect measure of ideological differences across states (Berry, et al. 1998; Erikson, et al. 1993), a fact that is also true when it comes to environmental issues. A review of League of Conservation Voters (LCV) congressional roll call voting scores indicates that Republicans from northeastern states tend to be more "green" than Republicans from western states. Likewise, LCV scores suggest that Democrats from southern states tend to be less "green" than Democrats from midwestern states. To control for these differences, I include Erikson, et al. (1993)'s measure of state ideology.

I also control for state economic and fiscal conditions. One might expect that states will curtail their environmental enforcement effort during difficult economic times. Helland (1998b), for example, found that the health of the local economy was an important predictor of the stringency of inspections taken by states under the Clean Water Act. States may be more willing to trade off the benefits of environmental regulation for the benefits of economic development during recessions, for example, especially if they believe that regulatory hur-

[9]These data come from Klarner's State Partisan Balance (1959-2000) dataset. I also considered various other measures of partisanship, but the results I report below were not sensitive to these different measures.

[10]I exclude Nebraska from this analysis, since their state legislature is nonpartisan.

dles are contributing to poor economic performance. Conversely, during periods of economic prosperity, we might expect state officials, all else equal, to be more willing to impose regulatory burdens.[11] To control for economic conditions, I include the state's unemployment rate in the model.[12]

State fiscal conditions too might influence the degree of environmental enforcement effort. State balanced budget and other rules may lead to cuts in expenditures in years in which tax revenues are less plentiful. Discretionary spending such as that funding state environmental enforcement efforts may be among the first programs to be cut, since it does not entail the elimination of public sector jobs. To control for such budgetary pressure, I include a "fiscal health" variable, which I measure by subtracting total state expenditures from total state revenues, divided by total state expenditures to normalize for the different sizes of state budgets.[13] Bacot and Hunter (1997) and Berry and Berry (1990) use similar measures in their analyses of state policy.

Another intrastate factor that could influence the pattern of state enforcement is the power of the interest groups most affected by federal pollution control regulation (Ringquist, 1993; but Potoski and Woods, 2002). A simple interest group story would maintain that states with influential industrial interests are likely to resist burdensome regulation and lobby against stringent enforcement practices, arguing that such practices harm their competitiveness and profitability. There is no good, direct measure of interest group strength that is commensurate across states and over time, so I use a proxy measure to capture this concept – the proportion of the state economy consisting of industries most affected by federal pollution control programs. Ringquist (1993) and Potoski (2001) use a similar measure in their studies of state environmental policy. More specifically, I use the manufacturing share of gross state product in the cases of air pollution and hazardous waste regulation, and the manufacturing and mining shares of gross state product in the case of water pollution regulation.[14]

[11]This idea is consistent with a recent paper by List and Sturm (2004) in which they develop a model of environmental policy as a secondary policy issue that incumbent politicians selectively manipulate according to varying electoral incentives.

[12]I compiled these data from the U.S. Bureau of Labor Statistics: http://www.bls.gov/lau/home.htm.

[13]These data were provided to me by U.S Census Bureau.

[14]I compiled these data from the U.S. Bureau of Economic Analysis:

I also control for the scope of the bureaucratic task environment. Perhaps, the simplest explanation for the level of enforcement effort put forth by a state is the degree to which regulatory enforcement is necessary. The simplest way to characterize the task environment in a state is the size of the regulated community – that is, the number of facilities coming under the jurisdiction of a program. I use the number of manufacturing establishments in each state as an estimate of the number of regulated facilities when considering the CAA,[15] the number of active facilities with National Pollution Discharge Elimination System (NPDES) permits when considering the CWA,[16] and the number of hazardous waste handlers when considering the RCRA.[17]

An alternative measure of the bureaucratic task environment might be the severity of the environmental problem facing the state, which may differ in some cases from the size of the regulated community. The suggestion here is that states confronting more severe pollution will engage in more stringent environmental enforcement, a relationship that some scholars have found to be strong (Davis and Davis, 1999; Lester, et al. 1983). This idea is sometimes referred to as the "matching hypothesis" (Potoski and Woods, 2002; Potoski, 2001). Unfortunately, good measures of pollution severity are lacking, and for this reason I do not consider this alternative characterization of the bureaucratic task environment in the model estimations I report here.[18]

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http://www.bea.gov/bea/regional/data.htm.

[15]I compiled these data from various years of the U.S. Census Bureau's *Annual Survey of Manufacturers.* Since these data are not available annually before 1999, I imputed the missing years using linear interpolation.

[16]Historically, facilities often had multiple permits (rather than a general permit for all discharges at the facility) so this measure is more precisely the number of active NPDES permits. I compiled these data from the EPA's IDEA database.

[17]Handlers here include large quantity generators of hazardous waste and treatment, storage and disposal facilities, but not entities that only transport hazardous waste. I collected these data from various years of EPA's *National Biennial RCRA Hazardous Waste Report.* These data are only available every two years, so I imputed the missing years with linear interpolation.

[18]I estimated several models (not reported) that included measure of problem severity. In the case of CAA enforcement, I included of air pollution severity – the percentage of counties in the state in nonattainment for at least one criteria air pollutant (Michael Greenstone graciously provided these data) – but the coefficients were never significant. There is not a good measure of the severity of water pollution at the state level, so I did not include such a measure in the water enforcement models. (The EPA does compile state-level information on water quality in its biannual publication *National Water Quality Inventory Report to Congress*, but the data are not unevenly reported by the states and do not appear commensurate over time.) Finally, in the hazardous waste enforcement models, I included a measure of the amount of hazardous waste generated in each state, but the coefficients never reached statistical significance.

Last, to control for basic state-level differences in demographics and socioeconomic characteristics, I include several additional control variables – per capita income, population, population density, and urbanization.[19] I also use state fixed effects to control for any time-invariant, state-specific factors that might also relate to regulatory enforcement effort, as well as year fixed effects to control for any year-specific shocks. Table 5.1 includes descriptive statistics for these variables, and the rest of the data described above.

5.2.2 Econometric Issues

There are several issues that must be addressed to estimate equation (1). First, the strategic interaction term, $\sum \omega_{ijt} E_{jt}$, must be defined. There are two components to this variable. First, an *a priori* assumption must be made regarding how to define a state's competitors. In practice, scholars have defined states' competitors in several ways, as there is no accepted convention. I use multiple definitions here. Perhaps, the most obvious definition is geographical contiguity, where it is assumed that states compete with the states with which they share a border. This seems plausible, for example, if firms identify a general region of the country in which they want to locate – perhaps, for reasons of market proximity – and then consider additional factors that differentiate states within a region.

I also consider a second geographically-based definition of state competitors. Rather than limit competitors to just a state's contiguous neighbors, an alternative definition used in some studies (e.g., Hernández-Murillo, 2003; Levinson, 2003) is one based on a state's proximity to all other states. This is a continuous measure that is typically computed as the inverse of the squared distance between states, where $\omega_{ij} = (1/d_{ij})^2$.[20] The assumption here is that states compete with all other states, not just their contiguous neighbors, and that the degree of this competition is a function of proximity (i.e., competition from closer states is more important than competition from states farther away).

I also use two regional economic classifications as alternative definitions of competitors,

[19] I compiled these data from the U.S. Bureau of Economic Analysis, *http://www.bea.gov/bea/regional/data.htm*.

[20] I calculated the distance using a formula that computes the shortest distance on a sphere between two points (i.e., the Haversine formula). I use the geographic coordinates for the population centroids of each state, computed by the U.S. Bureau of the Census for the years 1980, 1990, and 2000 (and use the same coordinates throughout the decade following the census year.)

one developed by the Bureau of Economic Analysis (BEA) and one developed by Crone (1998/1999). These regional economic classifications group together states in terms of their economic similarity, although the BEA measure also requires geographical contiguity. The assumption underlying this definition of competitor states is that states compete primarily to attract more of the same type of industries (perhaps, industries in which they already enjoy a comparative advantage). The regions defined by the BEA and Crone overlap, but there are some significant differences as well. Table 5.2 presents each of these classifications.

It is difficult to know the degree to which these different definitions accurately capture groups of states competing for economic investment. While we can observe where firms decide to site a new factory, for example, in most cases we do not know the other states it considered. In a recent paper, Greenstone and Moretti (2004) compile a unique dataset that allows us to gain some insight on this issue. They collected data on industry location decisions from a periodic feature in the corporate real estate journal, *Site Selection*, known as "Million Dollar Plants." These articles describe the details of a firm's decision of where to locate new, large industrial facility, and often identify the other finalists for the plant (usually two or three other locations). These data, therefore, provide a window into which states are competing for new economic investment opportunities, and at least a cursory check on the definitions discussed above for defining groups of competitor states. Greenstone and Moretti collected data for 82 plant location decisions (during 1982-1993), for which the finalists for the plant included contiguous neighbors about 39% of the time, BEA regional members about 41% of the time, and Crone regional members nearly 50% of the time. These data provide at least some evidence that the definitions of competitor states I use in this analysis have empirical validity.

The second component of the strategic interaction term is a weight, which determines the relative importance of each designated state competitor. I follow Fredriksson, et al. (2004) and Fredriksson and Millimet (2002b) and use three different weighting schemes. First, I consider all competitor states as equals, for which I assign a value of one to all states sharing borders under the contiguity definition of competitors and all states within the same region under the BEA and Crone economic classifications. I assign a value of zero to all other states.

The weight, thus, simplifies to the mean of the states' competitors and is time-invariant. I also weight competitor states by their relative "size," measured in terms of each state's share of the total population or the total income of the set of competitor states, such that $\omega_{ijt} = pop_{jt} / \sum_{j \in J_i} pop_{jt}$ or $\omega_{ijt} = inc_{jt} / \sum_{j \in J_i} inc_{jt}$, where J_i is the set of states competing with state i. Unlike weighting states equally, these weights vary each year. Considering the relative size and wealth of competitor states allows for the possibility that some competitors' regulatory behavior is more influential than others. I do not use any additional weighting when I define competitors using the distance among all other states. (I discuss additional evidence from my survey results in Chapter 7).

Another econometric issue that must be addressed to estimate equation (1) is the obvious endogeneity of the E_{jt}s. By design, modeling strategic interaction within the same year means that values of E in different states are jointly determined such that the linear combination of the E_{jt}s is endogenous and correlated with the error term, ϵ_{it}. Stated more simply, if the regulatory effort in state i is a function of the regulatory effort in state j, then the regulatory effort in state j must also be a function of the regulatory effort in state i. Because of this simultaneity problem, OLS estimates will be biased.

There are a couple of econometric approaches to addressing this simultaneity problem. First, one could use a maximum likelihood estimation of the reduced form of equation (1) (e.g., Brueckner and Saavedra, 2001; Saavedra, 2000; Besley and Case, 1995; Case, et al., 1993). Spatial maximum likelihood estimation, however, can be computationally demanding due to the large matrices necessary to estimate the spatial lag term. A second approach is a two-stage least squared instrumental variables approach (2SLS-IV), which is both easier to implement than spatial maximum likelihood estimation and generates unbiased and relatively efficient coefficients (Franzese and Hays, 2004). The 2SLS-IV approach has been used in numerous studies of strategic government interaction (e.g., Phillips, 2004; Hernández-Murillo, 2003; Levinson, 2003; Fredriksson and Millimet, 2002b; Altshuler and Goodspeed, 2002; and Figlio, et al., 1999). The standard application of the 2SLS-IV approach is to instrument for E_{jt} using the weighted characteristics of competitor states (Anselin, 1988). More specifically, equation (2) is estimated:

$$\sum_{j \neq i} \omega_{ijt} E_{jt} = a + b \sum_{j \neq i} \omega_{ijt} X_{jt} + \mu_{it} \quad (2)$$

where $\sum_j \omega_{ijt} X_{jt}$ is a weighted average of a vector of state i's competitors' characteristics. The fitted values can then be used as instruments for the spatial lag term in equation (1).

I use an instrument set that includes per capita income, population, population density, and urbanization,[21] that is, a subset of the variables included in the X_{it} vector of state attributes in equation (1).[22] In each model, the instruments are weighted using the same weighting scheme as competitors' environmental effort. For example, if competitors are defined as population-weighted contiguous states, so too are the competitors' characteristics.

Instrumental variables must satisfy two basic requirements: they must be correlated with the endogenous variable(s) in the model and uncorrelated with the errors. In the current application, appropriate instruments are ones that affect a state's environmental regulatory enforcement effort, but not the effort put forth in competitor states, conditional on the competitor states' efforts. I perform several diagnostic tests to check for the relevance and validity of the instrument set. First, I consider the significance of the excluded instruments in the first stage regressions, as well as the R^2 of the first stage regressions with the included instruments partialled out as recommended by Bound, et al. (1995). I also perform an F-test of the joint significance of the set of instruments from the first-stage regressions. Staiger and Stock (1997) suggest that when instruments are weak – which, as I explain below, is sometimes the case here – an F-statistic of above 10 is a useful rule of thumb for evaluating the relevance of the instruments.[23] Since the instrumental variables estimation in this case is overidentified – the number of instruments is greater than the number of included endogenous variables – I also conduct Hansen's overidentification test (also described by Wooldridge, 2001) to test the validity of the instruments. Last, I perform an augmented regression test to check for the endogeneity of the regressors (Davidson and MacKinnon, 1993).

A third problem that arises in estimating equation (1) occurs when ϵ_{it} includes omitted

[21] I compiled these data from the Bureau of Economic Analysis and the U.S. Census Bureau.

[22] Levinson (2003) and Fredriksson and Millimet (2002b) use a similar set of instruments in their strategic interaction models of state-level environmental regulation.

[23] This is the case only when there is a single endogenous variable, which is the case here.

variables that are themselves spatially-dependent. In this case, states may share some unobserved, regional characteristics that are correlated with regulatory effort. Spatial dependence in the errors would bias δ in favor of a spurious relationship, leading one to potentially mistake regional correlations for strategic behavior. For example, there might be a regionally-specific economic phenomenon that impacts a set of regional economic competitors. Alternatively, a change in federal oversight of state programs spearheaded by action taken by one of EPA's regional offices too might affect the behavior of states in a region. An additional advantage of the 2SLS-IV approach I employ in the analyses below is that this method generates consistent estimates even in the presence of spatial error dependence (Kelejian and Prucha, 1998).

5.2.3 Asymmetric Effects Models

Estimating the model represented by equation (1) will establish whether there is strategic interaction among states. While demonstrating such strategic interaction is necessary to support the race to the bottom argument, it alone is not sufficient. The race to the bottom argument suggests a specific asymmetric pattern of state responsiveness, which requires a modified model. More specifically, we should observe states responding to their competitors ıonly in situations when its own regulatory policy might put it at a disadvantage relative to these competitors. If, instead, we observe strategic interaction in state regulatory enforcement behavior in cases in which a state's own regulatory policy does not plausibly put itself at a disadvantage, then the race to the bottom argument seems unlikely to explain state environmental regulatory decisions.

To test for this hypothesized asymmetry in state responsiveness, I estimate two models. The first model considers whether strategic interaction occurs when competitor states' regulatory enforcement this year is less than it was in the previous year. The specification is as follows:

$$E_{it} = \delta_0 D_{it} \sum_{j=1}^{48} \omega_{ijt} E_{jt} + \delta_1 (1 - D_{it}) \sum_{j=1}^{48} \omega_{ijt} E_{jt} + \beta X_{it} + s_i + y_t + \mu_{it}, \qquad i = 1, ..., 48, j \neq i \quad (3)$$

where

$$D_{it} = \begin{cases} 1, & \text{if } \sum_{j=1}^{48} \omega_{ijt} E_{jt} < \sum_{j=1}^{48} \omega_{ijt-1} E_{jt-1}, \qquad j \neq i; \\ 0, & \text{otherwise.} \end{cases}$$

The parameter δ_0 is the measure of strategic interaction when the weighted average of a state's competitors' environmental enforcement efforts dropped from the prior year. If the weighted average of competitor states' environmental enforcement effort did not change or increased from the prior year, the parameter δ_1 represents the degree of strategic interaction. Support for the race to the bottom argument suggests that $\delta_0 > 0$, while δ_1 should not be statistically different than zero. This model closely resembles one used by Figlio, et al. (1999) to measure asymmetric effects in welfare competition.[24]

I also consider an alternative specification. Following Fredriksson and Millimet (2002b), I estimate the following model:

$$E_{it} = \delta_0 I_{it} \sum_{j=1}^{48} \omega_{ijt} E_{jt} + \delta_1 (1 - I_{it}) \sum_{j=1}^{48} \omega_{ijt} E_{jt} + \beta X_{it} + s_i + y_t + \mu_{it}, \qquad i = 1, ..., 48, j \neq i \quad (4)$$

where

$$I_{it} = \begin{cases} 1, & \text{if } E_{it} > \sum_{j=1}^{48} \omega_{ijt} E_{jt}, \qquad j \neq i; \\ 0, & \text{otherwise.} \end{cases}$$

The general idea here is the same as above. Strategic interaction consistent with the race to the bottom hypothesis suggests that we should observe state responsiveness to competitor states in years in which one's own regulatory effort is greater than one's competitors, but not in years which it is lower. That is, we should expect to see a large, positive coefficient for the parameter δ_0, but not δ_1. The difference between these two specifications is that equation (3) implies that states will respond to any competitors' decline in their regulatory effort, irrespective of whether the average stringency of competitors' enforcement remains higher than the state's own regulatory stringency. Equation (4), by contrast, assumes that this type of strategic interaction occurs only when the average stringency of competitors' enforcement is higher than the states' own level.[25]

[24] Since the enforcement data before 1985 are not reliable, I consider the years 1986-2000 here.

[25] There is some debate about which of these specifications reflect the most appropriate tests of the race to the bottom argument (Berry, et al. 2003 and Bailey and Rom (2004). Woods (2006a) tests both in his recent paper on mining enforcement, and I do the same here.

5.2.4 Time Lag Models

The models presented above assume that states' choices about regulatory enforcement are simultaneous. This presupposes that interstate influences of economic competition are both identified and acted on rapidly (i.e., within the same year), which requires a fluid flow of information across states. This type of quick policy responsiveness seems more plausible in the area of regulatory enforcement, than in regulatory standard-setting, since the former does not require administrative or legislative action. Nevertheless, intuitively, it seems more likely that either information spillovers across states are less fluid than suggested by the simultaneous strategic interaction model or that state policymakers are not able to immediately act on competition from other states – that is, it might take some time for a state to modify its own regulatory enforcement behavior in response to that of other states.

To test for this possibility, I estimate a slightly different model than equation (1) that incorporates a time lag. Similar models haves been used by Hayashi and Broadway (2001) in context of Canadian provincial taxes and Fredriksson and Millimet (2002b) in context of environmental regulation, among others. The specification is as follows:

$$E_{it} = \phi \sum_{j=1}^{48} \omega_{ijt-1} E_{jt-1} + \beta X_{it} + s_i + y_t + \epsilon_{it},, \qquad i = 1, ..., 48, j \neq i \tag{5}$$

where E_{it} is one of my dependent variables measuring state-level environmental enforcement in state i at time t, ω_{ijt-1} is the weight assigned to state j by state i at time *t-1*, E_{jt-1} is a measure of environmental enforcement in state j at time *t-1* – that is, one year ago (I also consider the case of *t-2*), X_{it} is a vector of state characteristics, s_i are state fixed effects, y_t are year fixed effects, and ϵ_{it} are errors uncorrelated over time, but potentially correlated across states. An additional attribute of this specification compared to equation (1) is that it does not raise concerns about the direction of causation and it remedies the simultaneity problem, since a state's current environmental regulatory effort cannot affect the past regulatory efforts of its competitor states. This model can be estimated with OLS.

Woods (2006a) estimates a similar model in his recent paper measuring the effects of interstate competition on state enforcement of federal surface mining regulation, as do Bailey

and Rom (2004) in their model of interstate welfare competition. Woods also tests the race to the bottom hypothesis, but he models the interstate influences differently. He constructs an "enforcement gap" variable, which sums the total number of enforcement actions a state takes in a given year, minus the average number of enforcement actions taken by its competitors in the same year. Woods then lags this variable one year to reflect the idea that states are unlikely to respond immediately to regulatory changes in competitor states.

5.3 Results

In this section, I report the results from estimating the models described above. To ease interpretation, I estimate the models after taking the natural log of both the dependent variable and the strategic interaction term. Thus, the coefficient on the parameter of interest δ is an elasticity. In some years, some states did not perform any inspections or take any punitive enforcement actions. Case-by-case evaluation strongly suggests that these are not missing values.[26] To address these values of zero, I added a small constant (1) to all observations to enable the logarithmic transformation, which is a standard solution to this problem (Cameron and Trivedi, 1998).

5.3.1 Baseline Model

I first estimate a simplified version of equation (1) which only includes a subset of the state characteristics in the X_{it} vector: per capita income, population, population density, and urbanization – that is, the same group of state characteristics comprising the instrument set. The reason for estimating this baseline model is that it is most comparable to the few existing studies in the literature that test for strategic interaction in U.S. state environmental regulation. Table 5.3 presents the coefficients for the parameter of interest δ in equation (1) for each of the six dependent variables. For all coefficients, I report standard errors that are robust to arbitrary heteroscedasticity.[27]

[26]Furthermore, my correspondence with the EPA officials that manage the IDEA database and the program specific databases that IDEA compiles its data from, indicated that there were no major problems with missing data for the years considered here. Moreover, the enforcement data I study in this paper are the same data that the EPA uses in its official statements about enforcement of federal pollution control programs.

[27]Pagan-Hall (1983) tests – not reported – detected heteroscedasticity in most of the regressions.

The first two rows present elasticities of strategic interaction for the dependent variables measuring state enforcement of the CAA. Considering the inspections measure first, I find evidence of strategic interaction in about half of the regressions, including all of the estimations when competitors states are defined using Crone's economic regions. The results for the more general measure of air pollution enforcement are slightly more robust, with the elasticities achieving statistical significance when using the distance-based definition of competitors and both of the regional economic classifications (and for all weighting schemes). The elasticities are in the range of about .6 to 1.3, suggesting that a 10% increase (decrease) in competitors' enforcement efforts leads to about a 6% to 13% increase (decrease) in one's own enforcement efforts.

Turning to the results for state enforcement of the CWA, the elasticities for inspections reach statistical significance across all of the different definitions of competitors. The results are about the same for the more general enforcement actions dependent variable. The coefficients presented in the fourth row of the table are consistently large in magnitude and statistically significant, except for the Crone region definitions of competitors. The elasticities range from approximately 1.0 to 1.3.[28] The fact that the coefficient on the parameter of interest exceeds one in these cases (and at times with the other dependent variables) suggests that states are responding by modifying their own effort at a greater than one-to-one rate. One explanation for this degree of strategic interaction is that responding with precision is difficult, and some states may over-compensate in their responses to changes in the regulatory behavioral of competitor states.

Last, the data on state enforcement of federal hazardous waste management under RCRA also shows strong evidence of strategic interaction. With these data, the coefficient for the strategic interaction variable reaches conventional levels of statistical significance across

[28] Although I do not report the results here, I also find strong evidence of strategic interaction when I consider the enforcement data for just those facilities with "major" NPDES permits. The EPA defines a major discharger as one that releases more than one million gallons of wastewater per day, or one that is a significant source of a pollutant of concern. All other dischargers are considered "minor." The distinction between major and minor dischargers is important since major facilities are supposedly given higher priority in the enforcement process, and, according to EPA guidance, should receive both more inspections and steeper sanctions in the case of violations (EPA, 1986). In reality, during the 1985-2000 period, there is very little distinction in the rate of inspections for major and minor dischargers.

each definition of competitors and for each of three weighting schemes. The elasticities are of similar magnitude as with the actions taken to enforce federal air and water pollution control regulation – ranging from about .6 to well greater than 1.0 in a couple of instances (and to above 3.0 in the case of the distance-based definition). These elasticities indicate that a 10% increase (decrease) in competitors' enforcement efforts leads to about a 6% to 16% increase (decrease) in one's own enforcement efforts.

The baseline model performs reasonably well against several diagnostic tests. In terms of the relevance of the instruments, the coefficients on the excluded instruments in the first-stage regressions (not reported) are significant at the $p < .05$ level in most of the model runs. In the estimations in which the strategic interaction terms is statistically significant, the partial $R^2 s$ range from about .05 to .42, which indicates that the instruments in some cases are weak. However, F-tests reject the null that the instruments are jointly insignificant in nearly all of the regressions at the $p < .01$ level, with F-statistics greater than 10 in most of the estimations, which is the standard put forth by Staiger and Stock (1997) as preferable in instrumental variables estimations with weak instruments. The instrument set also passes Hansen's overidentification test in more than half of the estimations, and in most of the models where the strategic interaction effect reached statistical significance. Finally, the models pass the augmented regression test for endogeneity at the $p < .05$ in most of the regressions. Overall, the models that defined competitors using either the BEA or Crone regions performed a little better, but there was little difference across the different measures of state environmental enforcement.

The results from the baseline model provide support for a conclusion that there is strategic interaction among U.S. states in their environmental enforcement behavior. Overall, the elasticities found here are consistent with those found in the existing literature (e.g., Levinson, 2003; Fredriksson and Millimet, 2002b). The next question to address is whether these results hold when controlling for various intrastate factors that should also theoretically help predict state-level enforcement behavior.

5.3.2 Complete Model

The baseline model discussed above assumes that state decisions about environmental enforcement are purely a function of interstate influences, as well as a set of general state attributes. The next step is to estimate a more complete model that controls for a full set of intrastate political and economic factors that too may influence a state's regulatory enforcement behavior. The results for estimating this model for state enforcement of the CAA, the CWA, and the RCRA are presented in Tables 5.4 through 5.6, respectively. For succinctness, I report the results for the complete model using contiguity, BEA region, and Crone region to define competitors, but only for the population weighting scheme. In addition to testing the explanatory power of the control variables, the key question for the strategic interaction hypothesis is whether the positive and statistically significant coefficients on the strategic interaction term observed in the baseline models remain present when controlling for these intrastate factors. If yes, then there is firmer evidence that a state's regulatory enforcement effort responds to the regulatory enforcement efforts of competitor states.

Beginning with the regression results for state actions taken to enforce the CAA, the first thing to note is that there remains a strong positive relationship between a state's enforcement behavior and its competitors' enforcement behavior.

As presented in Table 5.4, the elasticities are positive and statistically significant when using either the BEA or Crone regions to define competitors, although not contiguous states. The coefficients range in magnitude from about .7 to 1.6 which suggests that a 10% increase (decrease) in competitors' enforcement efforts leads to about a 7% to 16% increase (decrease) in one's own enforcement efforts.

The coefficients on the state political and economic control variables generally do not support their theorized effects, with several not reaching conventional levels of statistical significance in any of the regressions.[29] There is some evidence that the party affiliation of legislators (but, not governors) matter – with states with more Democrats in the legislature performing more enforcement. These results, however, are not robust across the different

[29]Interpretation of the state political and economic variables require a little care due to the natural log transformation of the dependent variable. The simplest interpretation is in terms of percentage change, where $\%\triangle Y = (100b) * \triangle x$ is an approximate measure of the percentage change in Y. However, as the change in log(y) increases, this approximation becomes increasingly inaccurate. The exact percentage change in Y is given by $\%\triangle Y = 100[exp(b\triangle x) - 1]$.

estimations. State ideology also does not provide much in the way of explanatory power. With respect to the effect of state economic conditions, the coefficient on state unemployment rate reached conventional levels of statistical significance in each of the regressions with the general enforcement actions dependent variable, but the relationship with enforcement is not in the hypothesized direction. Counterbalancing this effect is the proportion of the state economy that is based in manufacturing (my proxy measure of interest group strength) – the more manufacturing in the state, the fewer environmental enforcement actions taken by the state government. It is unclear why these variables would move in opposite directions, and it is worth noting that the coefficient on state unemployment rate is anomalous to the model estimations with this particular dependent variable.[30] Finally, budgetary pressure and the size of the regulated community were not good predictors of state enforcement effort of the CAA.

Turning to state enforcement of the CWA, the results share some similarities with those discussed above, but they also have some substantial differences. Again, of primary interest is the coefficient on the strategic interaction or spatial lag terms, which are presented in the first row of Table 5.5. When considering either the inspections or the more general measure of environmental enforcement, I find strong evidence of strategic interaction (across all three definitions of competitors), with the elasticities ranging from .5 to 1.3.

Regarding the control variables, the party affiliation of elected officials again does not support the predicted relationship. The coefficients on the Democratic governor and Democratic legislature variables are statistically significant in many of the regressions, but suggest that more Democratic representation means less environmental enforcement (with one exception). State ideology again had no discernible effect on state enforcement conducted under the CWA. The coefficients on state unemployment and state fiscal health are statistically different from zero in only one of the regressions. My proxy measures of interest group strength suggest some contradictory relationships. The positive coefficient on manufacturing strength in the range of about 8.5 to 11.1 implies that a state with one standard deviation more of the state economy in the manufacturing sector conducts about 55% to 70% more

[30]The coefficient on state unemployment rate is negative (although rarely statistically significant) in model estimations using each of the other dependent variables.

enforcement actions. The proportion of the state economy comprised of mining, however, suggests an opposite relationship. A one standard deviation difference in mining gross state product suggests about a 40% difference in the number of CWA enforcement actions taken by states. But again, these relationships lack consistency across the models.

Last, Table 5.6 presents the results for state enforcement of the RCRA. I find strong evidence of strategic interaction when using the economic regions to define competitors, but not when using contiguity. The elasticities range from about .8 to nearly .9, which suggests that a 10% increase (decrease) in competitors' enforcement efforts leads to about a 8% to 9% increase (decrease) in a state's own enforcement efforts. The relationship between partisanship and state enforcement effort here is the same as it was in the case with enforcement of the CWA. The more Democrats in the state legislature, all else equal, the fewer the enforcement actions the state performed. The coefficients for state ideology do not reach statistical significance, as is generally the case for the variables measuring state economic and fiscal conditions and interest group strength.

Estimating the strategic interaction models with the various intrastate political and economic control variables included, resulted in about equal performance in the diagnostic tests compared to the baseline model. The overall fit of the models improved only marginally – the R^2s are only slightly larger than was the case in the baseline models (not reported), which corresponds to the lack of explanatory power of most of the control variables. Regarding the instruments, the partial R^2s and the F-tests for the joint significance of the set of instruments collectively perform relatively well in the models. In the estimations with statistically significant coefficients for the strategic interaction terms, the partial R^2s range in value from about .06 to .35. The set of instruments remain relatively weak in many of the estimations, but pass the threshold set by Staiger and Stock (1997) in 15 of the 18 regressions. The models perform less well on Hansen's overidentification test. I was only able to reject the null hypothesis in eight of the 18 estimations. Finally, the models pass the augmented regression test for endogeneity at the $p < .05$ in all but five of the regressions, and in all but one in which the coefficient on the strategic interaction term reached statistical significance.

5.3.3 Asymmetric Effects Models

The findings summarized thus far provide relatively consistent support for the notion that states are engaged in strategic interaction in their environmental decision-making – that is, regulatory enforcement practices in one state are positively related to the regulatory enforcement practices of the states with which they compete for economic investment. The results are strongest when using the economic region classifications, although also in many of the estimations using contiguity to define states' competitors. Collectively, the coefficients on the strategic interaction term found in the results reported above provide some support for the regulatory competition hypothesis. However, race to the bottom theory suggests that the pattern of strategic interaction should take a particular form. Specifically, we should observe states engaging in strategic interaction relative to their economic competitors only when their own regulatory effort is putting them at a disadvantage for attracting potential economic investment.

To test the race to the bottom theory more directly, I first consider the asymmetric effects model represented by equation (3). Recall that the race to the bottom theory predicts that a state should respond to a drop in competitors enforcement activities, but not an increase. Therefore, the expectation is that $\delta_0 > 0$ and $\delta_1 = 0$.

I estimated equation (3) using each of my measures of state enforcement for the CAA, the CWA, and the RCRA, and for the contiguous, BEA, and Crone definitions of competitor states. For succinctness, I again only report the results when weighting competitors by population (the results are generally the same for the other weighting schemes), and I only present the coefficients in Table 5.7 for the parameters of primary interest. Looking across the point estimates for δ_0, the coefficients indicate some seemingly strong support for the contention that states respond to competitors' states regulatory behavior when the competitor states decreased the vigor of their enforcement efforts from the previous year. The coefficient is positive and statistically significant in about a third of the models, and ranges from approximately .6 to over 2.0, which implies that a 10% increase (decrease) in competitors' enforcement efforts leads to about a 6% to 20% increase (decrease) in one's own

enforcement efforts.

However, in all of the regressions that showed some support for the race to the bottom argument, there also appears to be a strong strategic interaction effect in cases where the weighted average of competitors' enforcement *increased* relative to the previous year – that is, $\delta_1 > 0$. Moreover, the elasticities are of about the same magnitude.[31] And, in one case, the only evidence of the strategic interaction suggests that regulatory competition is producing more stringent levels of environmental enforcement, which would be consistent with a race to the top in state environmental regulation, not a race to the bottom.

The results are much the same when estimating the alternative specification (equation (4)) aimed at detecting an asymmetric pattern of state responsiveness. In this model, the δ_0 parameter represents the degree of strategic interaction when a state's own enforcement effort is greater than that of its competitors, which is another situation in which the race to the bottom theory would predict that states would be responsive to the regulatory behavior of competitor states. The coefficients from these regressions are presented in Table 5.8. Again, across each of the federal pollution control programs and for different definitions of competitor states, there is good evidence of strong strategic interaction in cases where a state may be at competitive disadvantage. I find elasticities ranging from about .6 to 1.8, which suggests a similar degree of responsiveness as I estimated in the other asymmetric effects model. However, I again find the same type of evidence of strategic interaction in cases where a state's own enforcement effort was lower than of the weighted average of its competitors. The coefficients on δ_1 are often positive, statistically significant, and of about the same size as those on δ_0.[32]

In sum, the evidence from asymmetric models does not support the asymmetric pattern of strategic interaction predicted by the race to the bottom theory. While there is support for the idea that states respond to the regulatory behavior of competitors states when their own regulatory practices may place them at a competitive disadvantage, there is also strong indication that a countervailing effect is operative. This suggests that, at least for some

[31] With an F-test of equality, I cannot reject the null hypothesis that the responses are actually equivalent in 16 of the 18 regressions.

[32] According to an F-test of equality, I cannot reject the null hypotheses that the responses are equal in half of the regressions.

states, regulatory behavior in competitor states pulls their own regulatory effort up, and not down. The results from theses asymmetric models suggests that, while interstate factors do influence state environmental regulatory behavior, the effect is not uniform across states.

5.3.4 Time Lag Models

The final set of results I report are from the one-year and two-year time lag models, which are presented in Tables 5.9 and 5.10, respectively. For the sake of brevity, I only report the results for the parameter of interest – ϕ in equation (5) – and I once again take the natural log of both the dependent variable and competitors' environmental enforcement to ease interpretation.

First, consider the one-year lag model, the results of which are presented in Table 5.9. When considering the dependent variable measuring the number of enforcement actions taken by states under the CWA, the coefficient on the strategic interaction term is statistically significant in four of the ten regressions, and in all of the regressions using BEA regions to define groups of competitor states. The magnitude of the responsiveness, however, is about one-fourth of that found in the previous models where I modeled the strategic interaction as occurring within the same year. These results aside, I find scant evidence that the pattern of state responsiveness is characterized by a one-year lag. Across the other measures of state enforcement of federal air, water, and hazardous waste regulation, very few of the other coefficients are statistically different from zero.

I find a little more support for the idea that it takes a time for states to respond to regulatory behavior in competitor states in the two-year lag models. The coefficients on the strategic interaction term, reported in Table 5.10, are statistically different from zero in about half of the regressions, although the sign is not always positive. In terms of magnitude, the effect is much smaller than in the simultaneous models, ranging from about .1 to .2, which suggests that a 10% increase (decrease) in competitors' enforcement effort two years ago, leads to just a 1% to 2% increase (decrease) in one's own enforcement efforts this year.

One explanation for the reduced magnitude of the elasticities is that interstate competition may have a lingering effect on regulatory behavior, and states may continue to respond

to competitive pressures in years after the competition is first realized. Alternatively, it may be the case that there is slack in the system, and that state enforcement practices cannot be entirely turned on and off. (These ideas, however, are contradicted by the lack of strategic interaction findings in the one-year lag model.) Nevertheless, the smaller magnitude of the effect indicates the strategic interaction in environmental regulatory enforcement is occurring mostly within the same year. This suggests that states are engaged in a fluid and dynamic game, in which they are efficiently able to respond to changing regulatory behavior in other states. This seems plausible in the arena of enforcement - as opposed to standard-setting - since decisions can be made (and influence from state elected officials applied) quickly.

5.4 Discussion and Next Steps

To review the findings of this chapter, I find strong evidence of strategic interaction in state environmental regulatory behavior. Across multiple measures of regulatory enforcement and across three of the main federal pollution control programs, states respond quickly (within the same year) to the regulatory behavior of the states with which they compete of economic investment (defined and weighted in several different ways). These results are consistent with the notion that states engaged in regulatory competition in environmental regulation during the sixteen year period from 1985-2000.

Although the evidence of strategic regulatory behavior is robust, the asymmetric effects models do not provide strong support for the race to the bottom argument. I do find evidence that states respond to the regulatory enforcement effort of competitor states in cases where their own enforcement effort may plausibly put them at a disadvantage for attracting economic investment. However, I find just as strong a pattern of state responsiveness when a state's enforcement efforts (or lack thereof) already put them in "better" position than states with which they compete for economic investment.

One might speculate that this pattern of states increasing their regulatory effort in responses to increases by their competitors still reflects economic competition, but economic competition that takes another form. States competing for mobile capital in non-polluting industries, such as those in the service sector – want to provide amenities such as environ-

mental protection. We know that states advertise their public education and infrastructure to attract new firms, so perhaps they also highlight their "clean" environments. This pattern of behavior would support a race to the top type argument.

This race to the top-type behavior may also be an indication of policy coordination. States, confronted with a transboundary pollution problem, may act in cooperative fashion by agreeing (even if only tacitly) to simultaneously ratchet up their enforcement effort as means to address a common problem. As long a economic competitor states move in the same direction, no state loses its economic competitiveness.

Alternatively, it may be the case that the asymmetric response pattern as I have so far specified it is too simplistic as it assumes that all states respond uniformly to interstate economic competition. States may vary in important ways that affect their responsiveness to the regulatory behavior of other states. For example, large states (in economic terms) may not respond to small states, while small states may respond to both other small states and large states. Stated simply, the size of a state's economy may determine a state's susceptibility to interstate influences. Similarly, states that rely heavily on pollution intensive industries – that is, industries most affected by how pollution control regulation is enforced – may pay more attention to regulatory practices in other states, compared to those whose economies are mostly agriculture or service-based. Evidence supportive of these types of asymmetries would indicate that, while a race to the bottom does not accurately describe all states behavior, race to the bottom type dynamics may nonetheless describe how some states deal with interstate economic competition. In other words, some states may use their regulatory behavior as a competitive instrument, while others do not. I begin to address some of these possibilities in the next chapter.

Table 5.1 Descriptive Statistics

	Mean	Std. Dev.	Min.	Max.
State CAA inspections	.117	.118	.0001	.700
Competitors' CAA inspections	.141	.080	.023	.327
State CAA enforcement actions	.013	.015	.0000	.15
Competitors' CAA enforcement actions	.015	.010	.0004	.082
State CWA inspections	.033	.041	.0002	.803
Competitors' CWA inspections	.036	.033	.001	.223
State CWA enforcement actions	.036	.098	.0000	.926
Competitors' CWA enforcement actions	.054	.049	.001	.299
State RCRA inspections	.693	.637	.004	6.93
Competitors' RCRA inspections	.805	.450	.007	2.90
State RCRA enforcement actions	.558	509	.004	4.0
Competitors' RCRA enforcement actions	.589	.303	.020	2.18
Dem. Governor	.448	.495	0	1
Dem. Legislature (% both chambers)	.570	.127	.143	.947
State government ideology	50.5	21.9	0	97.9
State citizen ideology	49.9	12.6	9.25	93.9
Unemployment (%)	.058	.016	.022	.131
Fiscal health	.120	.074	-.117	1.25
Manufacturing GSP (% of total GSP)	.180	.063	.026	.336
Mining GSP (% of total GSP)	.017	.034	.0001	.399
No. manufacturing establishments (1000s)	16.6	14.1	.5	50.5
No. NPDES facilities (1000s)	7.56	5.82	.111	23.0
No. RCRA handlers (1000s)	1.00	.826	.011	4.32
Per capita income ($1000s)	21.7	5.25	9.89	41.5
Population (millions)	11.3	8.87	.454	33.9
Population density (per sq. mile)	221	222	4.67	1134
Urbanization (%)	.764	.128	.322	.944

$n = 768$ (48 states x 16 years).

Values are population-weighted, using BEA regions to define competitor states.

Table 5.2 Economic Classifications	
BEA Regions	
New England	Connecticut, New Hampshire, Maine, Massachusetts, Rhode Island, Vermont
Mideast	Delaware, Maryland, New Jersey, New York, Pennsylvania
Great Lakes	Illinois, Indiana, Michigan, Ohio, Wisconsin
Plains	Iowa, Kansas, Missouri, Minnesota, Nebraska, North Dakota, South Dakota
Southeast	Alabama, Arkansas, Florida, Georgia, Kentucky, Louisiana, Mississippi, North Carolina, South Carolina, Tennessee, Virginia, West Virginia
Southwest	Arizona, New Mexico, Oklahoma, Texas
Rocky Mountain	Colorado, Idaho, Montana, Utah, Wyoming
Far West	California, Nevada, Oregon, Washington
Crone Regions	
Region 1	Arizona, Maine, Massachusetts, Montana, New Hampshire, Utah
Region 2	Delaware, Illinois, Indiana, Iowa, Michigan, Ohio
Region 3	Alabama, Arkansas, Florida, Georgia, Kentucky, Mississippi, Missouri, North Carolina, Oklahoma, Rhode Island, South Carolina, Tennessee, Virginia
Region 4	Connecticut, Maryland, New Jersey, New York, Pennsylvania, Vermont, West Virginia
Region 5	California, Idaho, Kansas, Louisiana, Minnesota, Nebraska, Nevada, Oregon, Texas, Washington, Wyoming
Region 6	Colorado, New Mexico, North Dakota, South Dakota, Wisconsin

Table 5.3 Strategic Interaction of State Environmental Enforcement (Baseline Model), 1985-2000

	Contiguous			Distance	BEA Regions			Crone Regions		
	Equal (1)	Pop. (2)	Inc. (3)	Equal (4)	Equal (5)	Pop. (6)	Inc. (7)	Equal (8)	Pop. (9)	Inc. (10)
CAA inspections	0.534	-0.121	0.568	0.376	0.287	0.905**	0.299	0.835**	0.692**	0.868**
	(0.364)	(0.486)	(0.343)	(0.507)	(0.264)	(0.333)	(0.278)	(0.235)	(0.218)	(0.243)
CAA enforcement actions	0.186	-0.124	0.154	1.272**	0.596*	0.633**	0.701**	0.909**	0.739**	1.069**
	(0.458)	(0.259)	(0.464)	(0.469)	(0.236)	(0.176)	(0.258)	(0.202)	(0.155)	(0.201)
CWA inspections	1.432**	1.246**	1.211**	2.390**	1.007**	0.856**	0.944**	0.754**	0.420*	0.742**
	(0.317)	(0.228)	(0.275)	(0.491)	(0.184)	(0.156)	(0.184)	(0.219)	(0.171)	(0.211)
CWA enforcement actions	1.276**	1.334**	1.310**	1.362**	1.099**	1.167**	0.981**	0.357	0.324	0.323
	(0.382)	(0.412)	(0.398)	(0.514)	(0.283)	(0.320)	(0.276)	(0.250)	(0.240)	(0.255)
RCRA inspections	0.909***	0.692**	0.942**	0.866**	0.992**	0.949**	1.085**	0.646**	0.944**	0.842**
	(0.307)	(0.268)	(0.360)	(0.395)	(0.241)	(0.197)	(0.320)	(0.175)	(0.180)	(0.186)
RCRA enforcement actions	0.951**	0.284	0.806**	3.001**	0.973**	0.901**	0.912**	1.293**	0.969**	1.581**
	(0.308)	(0.368)	(0.307)	(1.49)	(0.261)	(0.258)	(0.233)	(0.423)	(0.236)	(0.393)

Coefficients are elasticities of strategic interaction. $n = 768$ (48 states x 16 years) for CAA; $n = 609$ (includes state-year combinations for states with NPDES authorization only) for CWA; $n = 672$ (includes state-year combinations for states with RCRA authorization only) for RCRA. Robust standard errors in parentheses. **Statistically significant at the .01 level; *statistically significant at the .05 level. Coefficients for state and time fixed effects, per capita income, population, population density, and urbanization are not reported.

Table 5.4 Strategic Interaction of State Enforcement of the Clean Air Act (Complete Model), 1985-2000

	DV = Inspections			DV = Enforcement Actions		
	Contiguous (1)	*BEA* (2)	*Crone* (3)	*Contiguous* (4)	*BEA* (5)	*Crone* (6)
Competitors' enforcement	0.561 (0.602)	1.596** (0.498)	0.789** (0.225)	-0.001 (0.264)	0.748** (0.196)	0.930** (0.187)
Dem. Governor	0.068 -0.057	0.123 -0.069	0.074 -0.058	0.131 -0.085	0.046 -0.09	0.185* -0.088
Dem. Legislature (% both chambers)	0.52 (0.553)	1.298* (0.544)	0.467 (0.470)	0.369 (0.705)	1.543* (0.690)	1.563* (0.700)
State ideology	-0.003 (0.003)	-0.002 (0.004)	-0.003 (0.003)	0.000 (0.004)	0.003 (0.004)	0.000 (0.004)
Unemployment (%)	-0.669 (4.668)	0.449 (3.188)	-3.846 (2.482)	12.762** (3.742)	7.985* (3.984)	10.682** (3.770)
Fiscal health	-0.100 (0.327)	-0.135 (0.458)	-0.035 (0.306)	0.550 (0.415)	0.508 (0.465)	0.357 (0.435)
Manufacturing GSP (% of total GSP)	-0.412 (1.346)	-0.823 (1.383)	-0.806 (1.250)	-4.722* (2.140)	-6.770** (2.374)	-4.509 (2.353)
No. facilities (1000s)	0.069 (0.060)	0.166* (0.071)	0.095 (0.062)	-0.048 (0.079)	0.077 (0.084)	0.088 (0.088)
Per capita income ($1000s)	-0.177** (0.048)	-0.155** (0.048)	-0.185** (0.043)	-0.208** (0.052)	-0.230** (0.056)	-0.206** (0.054)
Population (millions)	0.098 (0.078)	0.068 (0.084)	0.174* (0.077)	0.502** (0.076)	0.459** (0.083)	0.467** (0.087)
Population density (per sq. mile)	0.01 (0.008)	0.007 (0.006)	0.010* (0.004)	0.003 (0.005)	0.002 (0.005)	0.001 (0.005)
Urbanization (%)	-0.978 (1.624)	-3.421* (1.648)	-1.769 (1.512)	-1.242 (2.608)	-3.383 (2.728)	-3.393 (2.624)
R-squared	0.72	0.70	0.66	0.68	0.72	0.67
Partial R^2	0.02	0.06	0.29	0.08	0.20	0.23
F-test of joint significance	2.2 p =.07	7.8 p =.00	65.4 p =.00	9.8 p =.00	28.1 p =.00	39.8 p =.00
Hansen test of overidentification	p =.03	p =.45	p =.34	p =.00	p =.00	p =.00
Augmented regression test	p =.45	p =.01	p =.01	p =.01	p =.00	p =.00

Coefficients in first row are elasticities. n = 752 (47 states x 16 years). Competitors' enforcement is weighted by population. Robust standard errors in parentheses. **Statistically significant at the .01 level; *statistically significant at the .05 level. Coefficients for state and time fixed effects are not reported.

Table 5.5 Strategic Interaction of State Enforcement of the Clean Water Act (Complete Model), 1985-2000

	DV = Inspections			DV = Enforcement Actions		
	Contiguous (1)	*BEA* (2)	*Crone* (3)	*Contiguous* (4)	*BEA* (5)	*Crone* (6)
Competitors' enforcement	1.320** (0.283)	0.723** (0.161)	0.452** (0.163)	1.290** (0.451)	1.060** (0.360)	0.300 (0.280)
Dem. Governor	-0.200* (0.093)	-0.145 (0.081)	-0.173* (0.080)	0.089 (0.147)	0.267* (0.128)	0.173 (0.112)
Dem. Legislature (% both chambers)	-1.305 (0.820)	-2.126** (0.721)	-2.928** (0.687)	-0.577 (1.42)	-1.949 (1.09)	-2.741** (0.956)
State ideology	-0.004 (0.005)	-0.003 (0.004)	-0.004 (0.004)	0.01 (0.007)	0.012 (0.007)	0.01 (0.006)
Unemployment (%)	4.597 (4.895)	-2.407 (4.143)	-6.389 (3.821)	-2.227 (6.932)	-10.496 (6.547)	-5.751 (5.618)
Fiscal health	0.604 (0.439)	0.725 (0.394)	1.139* (0.496)	-0.12 (0.952)	-0.559 (1.023)	-0.146 (0.724)
Manufacturing GSP (% of total GSP)	-3.818 (3.398)	-3.399 (2.865)	-2.697 (2.612)	11.072* (4.973)	8.465* (4.02)	7.067 (4.199)
Mining GSP (% of total GSP)	-7.150* (2.861)	-4.705 (2.501)	-1.191 (2.151)	-4.294 (6.460)	-6.812 (5.335)	-12.655** (3.791)
No. facilities (1000s)	-0.117 (0.080)	-0.089 (0.057)	-0.07 (0.049)	0.091 (0.092)	0.214* (0.087)	0.128 (0.072)
Per capita income ($1000s)	-0.032 (0.056)	-0.100* (0.044)	-0.114** (0.038)	-0.048 (0.086)	0.006 (0.078)	-0.07 (0.060)
Population (millions)	0.111 (0.067)	0.128* (0.060)	0.232** (0.049)	-0.208 (0.166)	-0.18 (0.139)	-0.043 (0.090)
Population density (per sq. mile)	0.013** (0.005)	0.019** (0.004)	0.022** (0.004)	0.021 (0.011)	0.019* (0.009)	0.002 (0.006)
Urbanization (%)	-2.29 (2.987)	1.874 (2.334)	4.204 (2.201)	5.938 (5.045)	6.787 (4.516)	4.328 (3.945)
R-squared	0.69	0.61	0.75	0.68	0.78	0.75
Partial R^2	0.10	0.33	0.35	0.06	0.06	0.10
F-test of joint significance	19.6 p =.00	68.0 p =.00	53.2 p =.00	6.9 p =.00	11.7 p =.00	15.8 p =.00
Hansen test of overidentification	p =.33	p =.02	p =.01	p =.33	p =.02	p =.00
Augmented regression test	p =.00	p =.03	p =.13	p =.00	p =.00	p =.56

Coefficients in first row are elasticities). n = 593 (includes state-year combinations for states with NPDES authorization only). Robust standard errors in parentheses. **Statistically significant at the .01 level; *statistically significant at the .05 level. Coefficients for state and time fixed effects are not reported.

Table 5.6 Strategic Interaction of State Enforcement of the Resource Conservation and Recovery Act (Complete Model), 1985-2000

	DV = Inspections			DV = Enforcement Actions		
	Contiguous (1)	*BEA* (2)	*Crone* (3)	*Contiguous* (4)	*BEA* (5)	*Crone* (6)
Competitors' enforcement	0.406 (0.243)	0.815** (0.203)	0.821** (0.189)	0.394 (0.342)	0.874** (0.271)	0.910** (0.265)
Dem. Governor	0.017 (0.045)	0.038 (0.049)	-0.038 (0.051)	0.044 (0.049)	0.022 (0.050)	-0.027 (0.058)
Dem. Legislature (% both chambers)	-2.389** (0.500)	-1.970** (0.508)	-2.229** (0.468)	-1.11 (0.731)	-0.98 (0.603)	-1.044 (0.600)
State ideology	0.001 (0.003)	0 (0.004)	0.001 (0.003)	0.004 (0.004)	0.002 (0.004)	0.003 (0.004)
Unemployment (%)	-3.555 (2.620)	-4.775 (2.78)	0.518 (2.798)	-7.773* (3.483)	-5.888 (3.494)	-5.742 (3.257)
Fiscal health	0 (0.281)	0.105 (0.318)	0.051 (0.296)	-0.061 (0.380)	-0.017 (0.401)	-0.034 (0.416)
Manufacturing GSP (% of total GSP)	1.15 (1.442)	1.321 (1.473)	4.143* (1.685)	-0.975 (1.328)	-0.783 (1.374)	0.45 (1.398)
No. facilities (1000s)	-0.534** (0.123)	-0.446** (0.145)	-0.550** (0.127)	-0.594** (0.080)	-0.516** (0.098)	-0.572** (0.089)
Per capita income ($1000s)	-0.002 (0.031)	-0.022 (0.033)	-0.009 (0.032)	0.046 (0.030)	0.031 (0.034)	0.071* (0.032)
Population (millions)	-0.065 (0.072)	-0.13 (0.077)	-0.072 (0.071)	-0.029 (0.063)	-0.093 (0.072)	-0.042 (0.067)
Population density (per sq. mile)	-0.002 (0.004)	0.003 (0.004)	-0.002 (0.004)	-0.007 (0.004)	0.001 (0.004)	-0.007* (0.004)
Urbanization (%)	-0.493 -1.9	-1.563 (1.996)	0.456 (1.965)	-0.528 (1.783)	-3.513 (1.998)	0.791 (1.968)
R-squared Partial R^2	0.76 0.08	0.63 0.20	0.71 0.24	0.57 0.06	0.72 0.21	0.60 0.13
F-test of joint significance	11.2 p =.00	21.5 p =.00	51.4 p =.00	10.9 p =.00	13.2 p =.00	23.5 p =.00
Hansen test of overidentification	p =.03	p =.05	p =.26	p =.27	p =.59	p =.40
Augmented regression test	p =.07	p =.00	p =.00	p =.22	p =.00	p =.00

Coefficients in first row are elasticities. n = 657 (includes state-year combinations for states with RCRA Subtitle C authorization only) for RCRA. Robust standard errors in parentheses. **Statistically significant at the .01 level; *statistically significant at the .05 level. Coefficients for state and time fixed effects are not reported.

Table 5.7 Strategic Interaction of State Enforcement Behavior (Asymmetric Effects Model 1), 1986-2000

	DV = Inspections			DV = Enforcement Actions		
	Contiguous (1)	*BEA* (2)	*Crone* (3)	*Contiguous* (4)	*BEA* (5)	*Crone* (6)
Clean Air Act						
Competitors' Enforcement Lower Than Last Year (δ_0)	-1.094 (0.744)	0.788 (0.525)	0.654* (0.320)	-0.599 (1.248)	0.536 (0.344)	-0.107 (0.456)
Competitors' Enforcement Higher Than Last Year (δ_1)	-1.070 (0.823)	0.888 (0.516)	0.551* (0.228)	-1.759 (2.786)	0.618** (0.215)	0.380 (0.370)
Clean Water Act						
Competitors' Enforcement Lower Than Last Year (δ_0)	2.090* (0.952)	0.703* (0.305)	0.986 (0.745)	1.345* (0.554)	0.769 (0.436)	-0.243 (0.584)
Competitors' Enforcement Higher Than Last Year (δ_1)	1.731** (0.563)	0.784** (0.181)	0.384 (0.464)	1.262* (0.565)	0.891 (0.513)	0.254 (0.484)
RCRA						
Competitors' Enforcement Lower Than Last Year (δ_0)	0.666 (0.521)	0.549* (0.273)	0.745** (0.186)	0.633 (0.355)	0.730* (0.298)	1.189 (0.685)
Competitors' Enforcement Higher Than Last Year (δ_1)	-1.259 (1.271)	1.823** (0.666)	1.246* (0.533)	0.240 (0.580)	1.381* (0.613)	0.594 (0.423)

Coefficients are elasticities. n = 705 for CAA (48 states x 16 years); n = 559 for CWA (includes state-year combinations for states with NPDES authorization only); n = 646 for RCRA (includes state-year combinations for states with RCRA Subtitle C authorization only). Robust standard errors in parentheses. **Statistically significant at the .01 level; *statistically significant at the .05 level. Coefficients for state and time fixed effects, Democratic governor, Democratic legislature, state ideology, unemployment, fiscal health, manufacturing GSP (and mining GSP in CWA models), number of facilities, per capita income, population, population density, and urbanization are not reported.

Table 5.8 Strategic Interaction of State Enforcement Behavior (Asymmetric Effects Model 2), 1985-2000

	DV = Inspections			DV = Enforcement Actions		
	Contiguous (1)	*BEA* (2)	*Crone* (3)	*Contiguous* (4)	*BEA* (5)	*Crone* (6)
Clean Air Act						
Competitors' Enforcement Less (δ_0)	1.582 (1.026)	1.807* (0.714)	0.858** (0.212)	-0.005 (0.426)	0.375 (0.344)	0.475 (0.272)
Competitors' Enforcement More (δ_1)	2.547 (1.323)	1.590** (0.578)	1.386** (0.490)	0.983 (0.558)	1.343** (0.408)	1.354** (0.263)
Clean Water Act						
Competitors' Enforcement Less (δ_0)	1.087** (0.258)	0.602** (0.129)	0.288 (0.151)	1.089* (0.422)	0.623 (0.397)	-0.196 (0.426)
Competitors' Enforcement More (δ_1)	1.346** (0.232)	1.009** (0.185)	0.819** (0.196)	1.428** (0.378)	1.367** (0.352)	1.057* (0.443)
RCRA						
Competitors' Enforcement Less (δ_0)	0.494 (0.261)	1.509 (0.784)	0.953** (0.317)	0.253 (0.513)	0.668 (0.409)	0.682* (0.280)
Competitors' Enforcement More (δ_1)	1.652* (0.669)	-0.041 (0.612)	0.721** (0.250)	3.598 (5.005)	1.049** (0.310)	1.027** (0.264)

Coefficients are elasticities. n = 752 for CAA (48 states x 16 years); n = 593 for CWA (includes state-year combinations for states with NPDES authorization only); n = 657 for RCRA (includes state-year combinations for states with RCRA Subtitle C authorization only). Robust standard errors in parentheses. **Statistically significant at the .01 level; *statistically significant at the .05 level. Coefficients for state and time fixed effects, Democratic governor, Democratic legislature, state ideology, unemployment, fiscal health, manufacturing GSP (and mining GSP in CWA models), number of facilities, per capita income, population, population density, and urbanization are not reported.

Table 5.9 Strategic Interaction of State Environmental Enforcement (One-Year Lag Model), 1986-2000

	Contiguous			Distance	BEA Regions			Crone Regions		
Dependent Variable	Equal (1)	Pop. (2)	Inc. (3)	Equal (4)	Equal (5)	Pop. (6)	Inc. (7)	Equal (8)	Pop. (9)	Inc. (10)
CAA inspections	-0.185	-0.164	-0.210	0.079	-0.065	-0.170	-0.087	0.148	-0.012	0.124
	(0.110)	(0.104)	(0.110)	(0.155)	(0.111)	(0.109)	(0.110)	(0.131)	(0.106)	(0.127)
CAA enforcement actions	-0.116	-0.141	-0.100	-0.221	0.246**	0.194**	0.249**	0.081	0.216*	0.107
	(0.099)	(0.079)	(0.097)	(0.168)	(0.079)	(0.067)	(0.077)	(0.107)	(0.093)	(0.108)
CWA inspections	-0.135	0.093	-0.118	-0.344*	-0.004	0.021	-0.004	0.156	0.237*	0.163
	(0.105)	(0.110)	(0.106)	(0.166)	(0.091)	(0.096)	(0.093)	(0.107)	(0.095)	(0.104)
CWA enforcement actions	-0.077	-0.045	-0.070	-0.113	0.039	0.020	0.037	-0.103	0.041	-0.111
	(0.075)	(0.073)	(0.076)	(0.150)	(0.085)	(0.091)	(0.086)	(0.109)	(0.118)	(0.107)
RCRA inspections	0.096	0.079	0.094	-0.267**	0.074	0.073	0.074	-0.051	0.024	-0.038
	(0.069)	(0.063)	(0.069)	(0.098)	(0.048)	(0.047)	(0.048)	(0.110)	(0.107)	(0.114)
RCRA enforcement actions	-0.032	0.010	-0.021	-0.306**	0.019	0.063	0.021	0.051	0.121	0.073
	(0.056)	(0.061)	(0.058)	(0.076)	(0.069)	(0.066)	(0.069)	(0.095)	(0.087)	(0.096)

Coefficients are elasticities of strategic interaction. $n = 705$ (47 states x 15 years) for CAA; $n = 559$ (includes state-year combinations for states with NPDES authorization only) for CWA; $n = 646$ for RCRA (includes state-year combinations for states with RCRA authorization only). Robust standard errors in parentheses. **Statistically significant at the .01 level; *statistically significant at the .05 level. Coefficients for state and time fixed effects, Democratic governor, Democratic legislature, government and citizen ideology, unemployment, fiscal health, manufacturing GSP (and mining GSP in CWA models), number of facilities, per capita income, population, population density, and urbanization are not reported.

Table 5.10 Strategic Interaction of State Environmental Enforcement (Two-Year Lag Model), 1986-2000

	Contiguous			Distance	BEA Regions			Crone Regions		
Dependent Variable	Equal (1)	Pop. (2)	Inc. (3)	Equal (4)	Equal (5)	Pop. (6)	Inc. (7)	Equal (8)	Pop. (9)	Inc. (10)
CAA inspections	-0.267*	-0.233	-0.282*	0.008	-0.011	-0.123	-0.030	0.297*	0.073	0.281*
	(0.129)	(0.123)	(0.130)	(0.158)	(0.112)	(0.108)	(0.110)	(0.131)	(0.107)	(0.128)
CAA enforcement actions	-0.184*	-0.202*	-0.170	-0.199	0.225**	0.184**	0.232**	0.110	0.249**	0.136
	(0.092)	(0.078)	(0.091)	(0.167)	(0.077)	(0.066)	(0.076)	(0.108)	(0.092)	(0.107)
CWA inspections	-0.072	0.165	-0.060	-0.184	0.089	0.177	0.095	0.129	0.164	0.130
	(0.093)	(0.104)	(0.094)	(0.168)	(0.088)	(0.097)	(0.089)	(0.102)	(0.092)	(0.099)
CWA enforcement actions	-0.115	-0.097	-0.107	0.002	-0.186**	-0.204**	-0.186**	-0.050	-0.036	-0.050
	(0.067)	(0.063)	(0.068)	(0.143)	(0.069)	(0.069)	(0.069)	(0.088)	(0.071)	(0.087)
RCRA inspections	0.108*	0.127*	0.108*	-0.053	0.068	0.067	0.065	-0.008	0.051	-0.003
	(0.053)	(0.049)	(0.053)	(0.117)	(0.043)	(0.044)	(0.043)	(0.071)	(0.071)	(0.072)
RCRA enforcement actions	0.085	0.147*	0.099	-0.087	0.095	0.162*	0.098	0.037	0.124	0.077
	(0.053)	(0.062)	(0.055)	(0.092)	(0.069)	(0.077)	(0.070)	(0.089)	(0.083)	(0.090)

Coefficients are elasticities of strategic interaction. $n = 658$ for CAA (47 states x 14 years); $n = 525$ for CWA (includes state-year combinations for states with NPDES authorization only); $n = 616$ for RCRA (includes state-year combinations for states with RCRA authorization only). Robust standard errors in parentheses. **Statistically significant at the .01 level; *statistically significant at the .05 level. Coefficients for state and time fixed effects, Democratic governor, Democratic legislature, government and citizen ideology, unemployment, fiscal health, manufacturing GSP (and mining GSP in CWA models), number of facilities, per capita income, population, population density, and urbanization are not reported.

Chapter 6. Rescuing the Race to the Bottom Argument: the Role of State Economic Structure

Introduction

The analyses I performed in Chapter 5 represent tests of the central empirical predictions of the race to the bottom theory. I found strong evidence of strategic interaction in state environmental regulatory behavior, which suggests that states are engaged in regulatory competition. However, I found weak support for the asymmetric pattern of strategic interaction predicted by the race to the bottom theory. States seem to respond to the regulatory practices of their economic competitors, both in cases when doing so should give them a comparative advantage for attracting economic investment and when doing so would presumably put themselves in a worse-off position for attracting mobile capital.

The strategic interaction models I estimated, however, consider the average effect of interstate economic competition on state regulatory enforcement effort. In so doing, these models may mask some critical underlying heterogeneity across states in the relationship between perceptions of competitiveness and environmental regulatory effort. States may differ in important ways that make them more or less susceptible to the influences of interstate economic competition, and therefore make them more or less likely to engage in the type of regulatory competition that might lead to relaxation of environmental protection effort. I refer to this as the susceptibility hypothesis.

None of the existing empirical literature evaluating the race to the bottom argument has considered the potential that there is underlying variation in the susceptibility of state's to the pressures of interstate economic competition. The strategic interaction models estimated by Fredriksson and Millimet (2002b) Levinson (2003), and Fredriksson, et al. (2004), similar to the analyses I conduct in Chapter 5, implicity assume that each state as an equal propensity to engage in the type of regulatory competition that may lead to a race to the bottom type dynamic in state environmental regulation. In this chapter, I consider three attributes of state economic structure which may help to predict which states are engaged in regulatory competition: size of the state economy, pollution-intensity of the economy, and the mobility

of manufacturing capital in the economy. By considering variation across state economic structure, it may be possible to rescue the empirical foundation of the race to the bottom argument. Moreover, this type of analysis pushes harder on the race to the bottom theory by examining more specific conditions in which we might expect to see interstate economic pressures affecting state regulatory behavior.

The balance of the chapter is as follows. In section 6.1, I discuss the three economic attributes I examine in more detail, as well as how I measure each for the empirical analyses that follow. In section 6.2, I describe how I modify the strategic interaction models to test the susceptibility hypothesis. I present the results from the modified strategic interaction models in section 6.3, and discuss the implications of these results in section 6.4.

6.1 State Susceptibility to Regulatory Competition

States may be more or less susceptible to interstate economic competition, depending on the structure of their economy. I consider three attributes of state economic structure that might help to explain which states are engaged in the type of strategic interaction indicative of regulatory competition. I describe each of these attributes below.

First, I consider the size of the state economy. One might posit that states with large economies are relatively more immune from the pressures of interstate economic competition. States with large economies are also likely to have more diversified economies, which further should alleviate the pressure to respond to interstate economic competition by using their environmental regulation as a competitive instrument. By contrast, states with small economies may respond in an opposite manner. These states should feel more pressure to use their regulatory practices as an instrument for attracting mobile capital, since on the margin, they gain more by adding new economic investment than would a larger state. Of course, on the margin, states with smaller economies also stand to lose more, if existing capital moves to states with less stringent environment regulations.

To measure the size of the economy, I use each state's gross state product. These data are available on an annual basis from the Bureau of Economic Analysis.[1] In Table 6.1, I

[1]These data are available from: http://www.bea.gov/bea/regional/data.htm.

present state gross product data for each state in 2000 (excluding Alaska, Hawaii, and the District of Columbia), ranked from the largest to the smallest state economy. Although state gross product varies from year to year, the rank ordering of state economies does not change too much during the 1985-2000 time period I consider here, so the ranking in Table 6.1 are generally representative of the relative size of the state economies in any given year in the time-series.[2]

A second attribute of state economic structure that may help predict how states respond to interstate economic competition is the "pollution-intensity" of their economy. States with economies comprised largely of industries most affected by pollution control regulations (e.g., manufacturing), may have more inclination to use these regulations as a competitive instrument. By contrast, states with economies consisting more of agriculture or service-oriented industries would seem less likely to use their environmental regulation this way, since it would not be an efficacious strategy for bringing in (or retaining) this type of economic investment. This is not to say that these state do not actively respond to interstate economic competition for these less pollution-intensive industries. However, it seems more likely that they would use other policy tools as competitive instruments, such as tax incentives or worker training programs.

There is no obvious way to construct a measure of the pollution-intensity of a state economy. For the purposes of this chapter, I modify a measure developed by Templet (1993a, 1993b). Templet created an "emissions-to-jobs" ratio measure by dividing the annual, total toxic discharges by the chemical industry in a state (SIC 28) by the number of workers in the chemical industry. I compute a similar measure, although I use all industries, rather than just the chemical industry.[3] Specifically, I use annual toxic emissions aggregated to the state level as reported in the Toxic Release Inventory (TRI)[4] divided by the total number of

[2]The spearman rho correlation is about .99 between gross state products in 1985 and 1990, 1990 and 1995, and 1995 and 2000.

[3]The spearman rho correlation between the rank of total emissions/total workers and chemical emissions/chemical works (Templet's measure) is 0.63. I chose to use the more general measure because of the uneven presence of the chemical industry across the country.

[4]The TRI was created as part of the 1986 amendments to the Comprehensive Environmental Recovery, Compensation, and Liability Act (better known as Superfund), and requires companies to report their emissions of specified toxic chemicals to the U.S. Environmental Protection Agency (EPA) on an annual basis. I would like to thank Vimla Mariwalla and Tim Antisdel at the EPA for providing me with the TRI

employed individuals in the state.[5] In essence, this is a measure of toxic emissions per state worker, and is a measure that is commensurate across states over time.[6]

In Table 6.2, I present the rankings of the pollution-intensity of state economies, using the average over the period of 1987-2000 since the measure varies for each state over time (the TRI data were first reported for year 1987). The mean pollution-intensity across the states was approximately 46 pounds of toxic discharges per worker (standard deviation of about 87.4 pounds per worker). The states with the most pollution-intensive economies are those with either low population densities (e.g., Nevada, Utah, Montana) and/or considerable chemical manufacturing bases to their economies (e.g., Louisiana, Alabama, Mississippi). States with the least pollution-intensive economies include primarily northeastern states such as Vermont, New York, Massachusetts, and New Jersey. Figure 6.1 provides another way to consider variation in the pollution-intensity of state economies. In this figure, I graph the emissions per worker by total emissions for 1995 (chosen arbitrarily). To provide some indication of how states compare along this measure, I have included a line representing the national median in this year, which was about 18 pounds of toxic discharges per state worker.

A third factor which may make a state more or less susceptible to interstate economic competition regards the mobility of capital. Although regulatory competition theory often is conceptualized in terms of competition for new economic investment, the logic also holds strongly in terms of competition to retain existing investment. As Davis and Davis (1999) argue, whether or not firms actually move to locations where environmental regulations are less stringent, business lobbies certainly push for regulatory policies that minimize compliance costs, using a message that business climate is an important concern in siting decisions. In other words, the mere threat of capital flight may be sufficient to cause state regulators

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data.

[5]I compiled these data from the Bureau of Economic Analysis.

[6]The chemicals that the EPA requires companies to report to the TRI changes from time to time. The most significant change came beginning with the 1988 TRI, when companies in the metal mining (SIC 10), coal mining (SIC 12), electric, gas and sanitary services (SIC 49), wholesale trade-nondurable goods (SIC 51), and business services (SIC 73) were required to report their emissions for the first time. Because these changes affect all states equally and at the same time, the emissions per worker issue is meaningful across states and over time.

– or the state elected officials that can use their political control of the bureaucracy to affect regulatory behavior – to modify their regulatory climate in manner such that the state remains an attractive place for industries to do business.

On the state-level, thus, the degree to which a state's economy is comprised of industries that can more easily move to new locations should help predict the extent to which a state uses policy tools as competitive instruments. States with economies consisting of large proportions of mobile capital should be more likely to respond to the pressures of interstate economic competition than states with economies consisting of large proportions of fixed capital. Regarding the propensity of states to use their environmental regulation as a competitive instrument, the key factor should be the proportion of pollution-intensive industries in the state that are mobile.

To measure the geographic-mobility of pollution-intensive industries in a state, I adapt a measure employed by Ederington, et al. (2005) in their study of the effect of environmental regulations on trade flows. In this study, they argue that it is necessary to account for the fact that pollution-intensive industries also tend to be less geographically mobile or "footloose," when studying the effects of regulations on trade patterns. In their statistical models, they consider three measures of geographic immobility: transportation costs in product markets, plant fixed costs, and agglomeration economies. In my analyses, I used a modified version of their measure of plant fixed costs.

While companies in all industries could threaten to leave a state for another state with lower environmental compliance costs, for companies in some industries, this is unlikely to be a credible threat. The microeconomics of industry location decisions are such that for some industries, it simply would not pay to move locations to reduce environmental compliance costs due to the large fixed costs of their existing operations. That is, industries with large fixed costs should be less sensitive to environmental regulations, because the costs of moving operations to a state with less stringent regulations are less likely to outweigh the gains in compliance costs. In contrast, companies in industries with low fixed costs may find that moving does generate cost savings (Ederington, et al. 2005). Following Ederington, et al. (2005), I measure plant fixed costs with industry-level (manufacturing industries only

(SIC codes 20-39)) data on real capital structures, normalized by the total value of industry shipments.[7] These data are available for 1985 through 1996 only. To account for the fact that industrial composition of state economies differ, I then construct a weighted average of this measure, where the weights are the gross state product of each manufacturing industry divided by the total gross state product of all manufacturing industries.[8] This measure, thus, captures the degree to which the manufacturing base in the state is comprised of mobile industries – that is, industries more likely to move to jurisdictions with less stringent environmental regulations.

I present the state rankings for the mobility measure in Table 6.3. Higher values represent higher proportions of manufacturing base of state economy in industries with large fixed costs. Again, since this measure varies for each state by year, I present the state averages over the ten year period from 1985 through 1996. The five states with economies with the most geographically-immobile industrial bases according to this measure are (in order) West Virginia, Louisiana, South Carolina, Delaware, and Indiana, while the five states with economies with the most geographically-mobile industrial bases are (in order) Washington, Kansas, South Dakota, Nebraska, and North Dakota. I also present this measures in Figure 6.2 for the year 1996, graphed against the total manufacturing gross state product for the state. Again, to provide some indication of how states compare along this measure, I have included a line representing the national median in this year, which was about 0.11.

6.2 Modeling the Role of State Susceptibility

To test the idea that a state's economic structure makes it more or less likely to engage in regulatory competition in a manner consistent with the race to the bottom argument, I again estimate a series of strategic interaction models. As was the case in the previous chapter, these models attempt to detect the degree of state responsiveness to the environmental regulatory behavior of economic competitor states. Here, though, I will specifically consider whether a state's susceptibility to the pressures of interstate economic competition help

[7]These data come from Bartelsman, et al. (2000)'s NBER-CES Manufacturing Industry Database, available at http://www.nber.org/nberces/nbprod96.htm.

[8]I compiled the gross state product data from the Bureau of Economic analysis website at http://www.bea.gov/bea/regional/data.htm.

predict which states use their environmental regulation as a competitive instrument.

To begin this discussion, recall the basic strategic interaction model I estimated in Chapter 5:

$$E_{it} = \delta \sum_{j=1}^{48} \omega_{ijt} E_{jt} + \beta X_{it} + s_i + y_t + \epsilon_{it}, \qquad i = 1, ..., 48, j \neq i \tag{1}$$

To test the effect of the state economic attributes, I modify this model in a couple of ways. First, I divide the states into two groups depending on whether they fall above or below the national mean each year according to the measure. My hypothesis is that states with smaller, more pollution-intensive, or more mobile economies are more likely to respond to the environmental regulatory behavior of economic competitor states. Accordingly, I posit that states with economies below the mean gross state product for all states, above the mean pollution-intensity for all states, and below the mean capital mobility will be *more* likely to respond to their economic competitors.

I re-specify equation (1) in a manner similar to how I specified the asymmetric models in Chapter 5. I use an indicator variable to designate whether a state is above or below the mean for all states. Considering the size of the state economy first, the specification is as follows:

$$E_{it} = \delta_0 M_{it} \sum_{j=1}^{48} \omega_{ijt} E_{jt} + \delta_1 (1 - M_{it}) \sum_{j=1}^{48} \omega_{ijt} E_{jt} + \beta X_{it} + s_i + y_t + \mu_{it}, \qquad i = 1, ..., 48, j \neq i \tag{2}$$

where

$$M_{it} = \begin{cases} 1, & \text{if gross state product}_{it} < \text{mean gross state product}_k; \\ 0, & \text{otherwise.} \end{cases}$$

where k = all states ($k \neq i$), and the rest of the variables are defined in the same way as the analyses in Chapter 5 . With this specification, the degree of strategic interaction is measured

by $\delta_0 > 0$ for states with less than the national mean gross state products, and by $\delta_1 > 0$ for states with above the national mean gross state products. If states with smaller economies are, in fact, more likely to respond to the regulatory behavior of competitor states, we should find that $\delta_0 > 0$, while δ_1 should not be statistically different than zero. In these models, I maintain the assumption that states compete with a set group of states, again defining competitors by contiguity and by the BEA and Crone economic regional classifications.

I consider analogous models for the other two attributes of state economic structure. First, with respect to the pollution-intensity of state economies, I consider equation (2) for the case:

where

$$M_{it} = \begin{cases} 1, & \text{if pollution-intensity}_{it} > \text{mean state pollution-intensity}_k; \\ 0, & \text{otherwise.} \end{cases}$$

Again, the susceptibility hypothesis suggests that $\delta_0 > 0$, while δ_1 should not be statistically different than zero. Finally, I consider equation (2) for the case of the geographical-mobility of manufacturing industries in the state:

where

$$M_{it} = \begin{cases} 1, & \text{if capital mobility}_{it} < \text{mean state capital mobility}_k; \\ 0, & \text{otherwise.} \end{cases}$$

Once again, I set up the model such that support for the susceptibility hypothesis will come if $\delta_0 > 0$, and $\delta_1 = 0$.

I also consider an alternative classification of the states according to these measures of state economic structure. Rather than compare the states with the measures relative to all other states, I consider them relative to their economic competitor states only. For example, in the case of the size of the state economy, the indicator variable, M_{it}, in equation (2) equals

1 if a state's gross state product is less than the mean gross state product of its competitors. I do the same then for the pollution-intensity and capital mobility measures.

I estimate these models using the same 2SLS-IV approach as in Chapter 5, and with the same state level enforcement data for the federal Clean Air Act (CAA), Clean Water Act (CWA), and the Resource Conservation and Recovery Act (RCRA), the same control variables, and the same set of instruments to address the endogeneity of state enforcement behavior. For succinctness, I only present the results when using population-weights for competitor states (instruments are also weighted by population). The data I used to create the susceptibility measures are not available for the entire 1985-2000 time period, with the exception of the state gross product data I use to measure the size of the state economy. In the case of the pollution-intensity of the state economy, the TRI data were available only from 1987-2000, while the fixed plant costs data used to create the capital mobility measure were available only from 1985-1996.

6.3 Results

I report the results from the first series of estimations in Tables 6.4 through 6.6. In these tables, I present the coefficients for the strategic interaction term only, considering the cases when I divide the states into two groups based on whether they fall above or below the national mean for each of the three state economic structure measures. As previously, to ease interpretation, the coefficient for the strategic interaction term are elasticities. Again, in each case, the susceptibility hypothesis predicts that we should observe higher levels of strategic interaction for states with smaller, more pollution-intensive, or more mobile economies.

Beginning with the results for the size of the state economy, the results shown in Table 6.4 present some fairly robust evidence that the size of the state's economy is a good predictor of whether they respond to the regulatory behavior of competitor states. In half of the regressions, the only statistically significant evidence of strategic interaction is for states with smaller economies – that is, the coefficient on the strategic interaction term for states with below the national average size of the economy is statistically significant, but the coefficient for states with above the national average is not. I find elasticities in the range of .4 to 1.1 in

these cases. There is some evidence that size of the state economy matters across each of the three federal pollution control programs and across each of three definitions of competitor states. The strongest evidence comes when considering enforcement of the CWA and the RCRA and when using the economic regions to define economic competitors. In a few of the models, I find evidence of comparable strategic interaction for both states with small and large economies, but in only one case, does the only evidence of strategic interaction come for states with larger economies – state inspections taken under the CAA, when using the Crone regions to define competitors.

The evidence is much less persuasive when considering variation in the pollution-intensity of state economies. As presented in Table 6.5, I only find evidence consistent with the susceptibility hypothesis in one of the eighteen models. Moreover, in about a third of the models, the only evidence of strategic interaction is with respect to states less pollution-intensive economies than the national average. In the rest of the cases, there is either equivalent strategic interaction for both states with more and less pollution-intensive economies, or no evidence of strategic interaction at all.

Turning to the results for the capital mobility measure of state economies, there is also not much evidence of strategic interaction when I group the states according to this measure.[9] As shown in Table 6.6, I only find evidence that the potential geographic mobility of the state manufacturing sectors influences the degree of state responsiveness to other states' environmental enforcement efforts in two of the models.

The results discussed above consider cases when I classified that states as more or less susceptible to engaging in regulatory competition, determined by whether they were above or below the national mean for each of the three state economic attributes. In the next set of models, I consider the states only as they compare to their economic competitors. The idea here is that a state's susceptibility may reflect how it compares along these measures not with all other states, but with just those that it competes with for economic investment. As I explain below, the results closely correspond to those from above.

Table 6.7 contains the strategic interaction coefficients when I compared the size of a

[9]This may, in part, be due to the loss of precision with these estimations due to the smaller sample sizes (these models consider fewer years).

state'e economy relative to its economic competitors. The size of a state's gross state product compared to its competitors does seem to explain its degree of strategic interaction, and there is some evidence across four of the six measures of environmental regulatory enforcement and across both the BEA and Crone definitions of competitor states. The strongest evidence of state responsiveness to competitors is in the case of state enforcement of federal hazardous waste regulation, across both the inspections and the punitive enforcement actions measures. Overall, I find elasticities that range from approximately .6 to 1.2.

The susceptibility hypothesis again performs poorly when I consider both the pollution-intensity of the state economy and the geographic mobility of the manufacturing sector of the state economy measures. As presented in Table 6.8 and Table 6.9, respectively, there is not much evidence of the type of strategic interaction in state regulatory enforcement behavior we would expect if states are engaged in environmental regulatory competition. In most of the cases where I find evidence of strategic interaction, it is about equivalent for state above and below the mean levels of these economic attributes compared to their economic competitors. In only one of the models that considers pollution-intensity and two models that consider capital mobility, is there evidence supportive of the susceptibility hypothesis.

6.4 Conclusion

In this chapter, I have examined the possibility that there is underlying variation in the susceptibility of states to the forces of interstate economic competition. I theorized that states with smaller economies, more pollution-intensive economies, and more mobile economies would be more likely to engage in the type of strategic interaction indicative of regulatory competition. The results from the analyses were mixed. I found strong evidence from the strategic interaction models that the size of a state's economy seems to matter. States with below average size economies – both, compared to all other states and compared to economic competitor states – often responded to their competitors' environmental regulatory enforcement behavior, while states with above average size economies did not. This provides some evidence that states with larger economies are more immune to the pressures of interstate economic competition, than are states with smaller economies. However, when

I consider two alternative measures of susceptibility, the evidence is far less convincing. Although there remains some evidence of strategic interaction, it did not vary consistently for states with above mean pollution-intensities and above mean capital-mobility in manufacturing.

In sum, considering state economic structure helps rescue the race to the bottom argument, but only somewhat. The results seems to suggest that the key factor in susceptibility is the overall size, rather than the composition, of a state's economy.

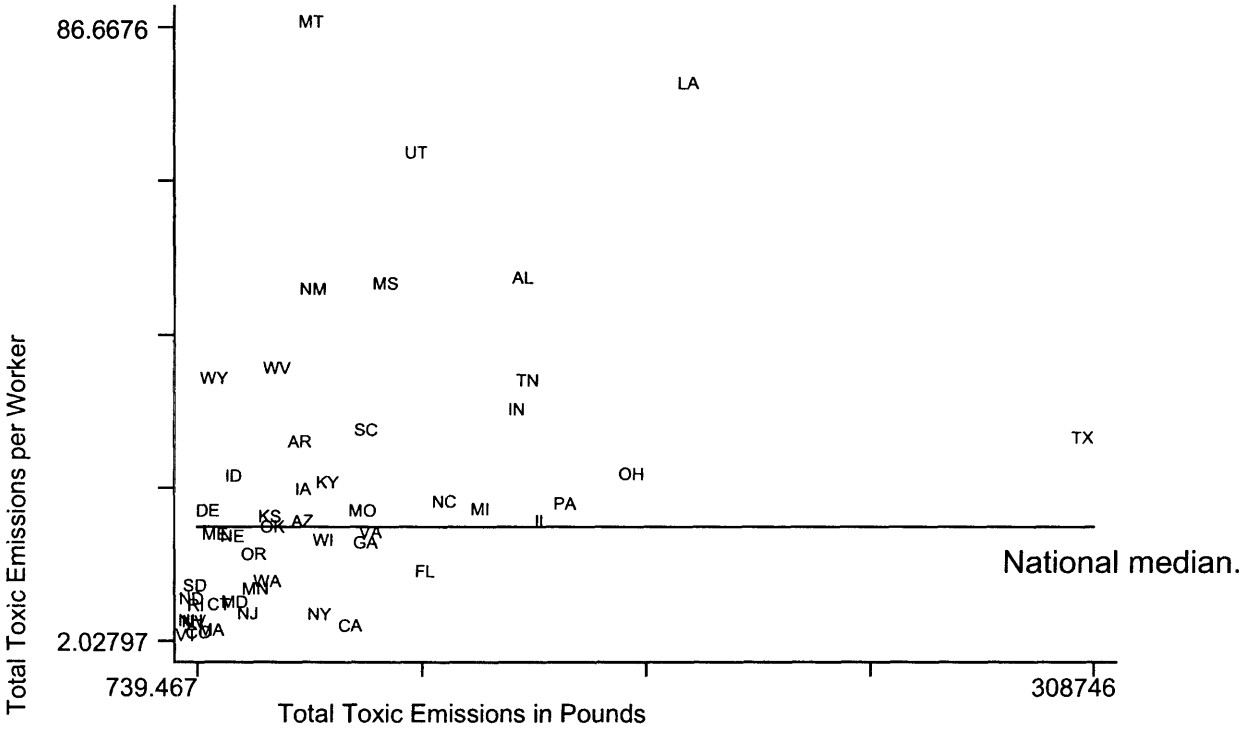

Figure 1: State Pollution-Intensity, 1995

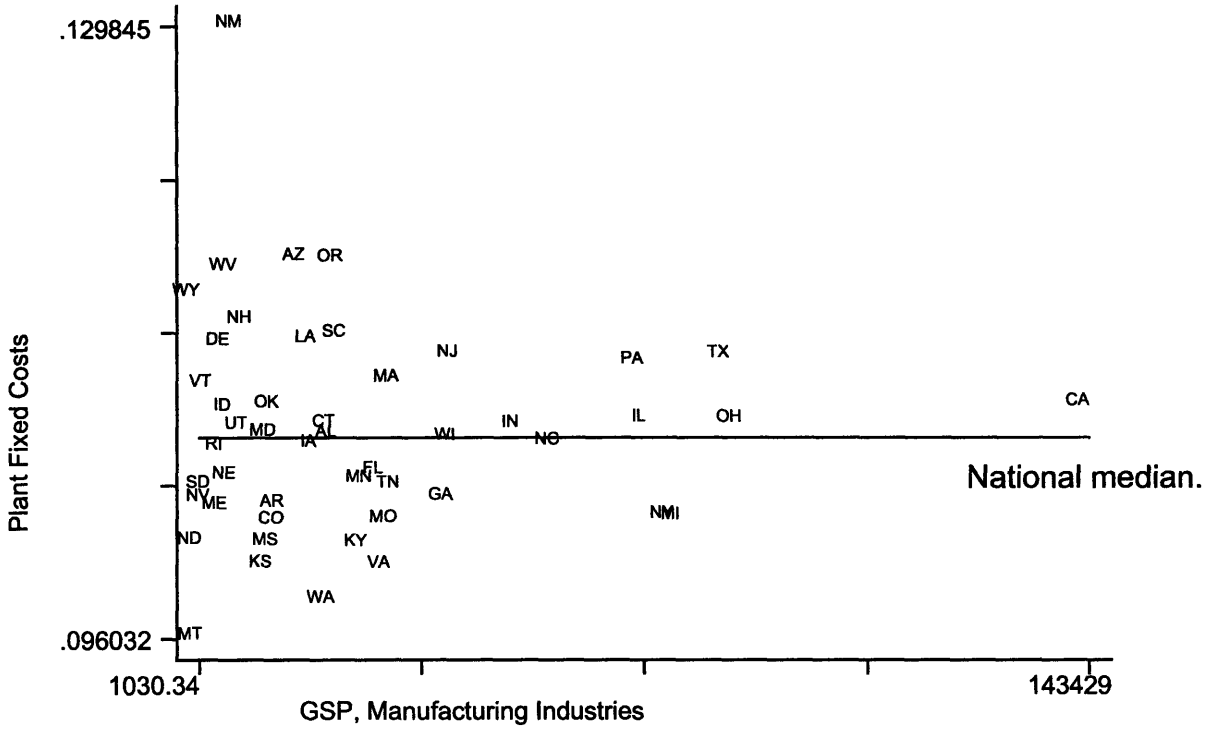

Figure 2: Mobility of State Manufacturing Industries, 1996

Table 6.1 States Ranked by Gross State Product, 2000

Rank	State	Gross State Product (millions $)	Rank	State	Gross State Product (millions $)
1	California	1,296,637	25	Alabama	116,265
2	New York	762,096	26	Kentucky	113,311
3	Texas	723,842	27	South Carolina	112,977
4	Florida	469,532	28	Oregon	112,587
5	Illinois	466,338	29	Iowa	91,488
6	Pennsylvania	394,649	30	Oklahoma	90,266
7	Ohio	371,952	31	Kansas	83,617
8	New Jersey	345,519	32	Nevada	73,528
9	Michigan	337,976	33	Utah	68,038
10	Georgia	289,145	34	Arkansas	66,700
11	Massachusetts	277,103	35	Mississippi	64,930
12	North Carolina	273,278	36	Nebraska	55,869
13	Virginia	258,280	37	New Mexico	50,515
14	Washington	220,459	38	New Hampshire	42,655
15	Indiana	195,881	39	West Virginia	42,393
16	Minnesota	185,199	40	Delaware	42,129
17	Maryland	179,929	41	Maine	35,485
18	Wisconsin	177,561	42	Idaho	35,251
19	Missouri	175,948	43	Rhode Island	33,504
20	Tennessee	175,350	44	South Dakota	23,140
21	Colorado	170,350	45	Montana	21,535
22	Connecticut	157,988	46	North Dakota	17,936
23	Arizona	157,424	47	Vermont	17,799
24	Louisiana	131,531	48	Wyoming	17,798

Source: Bureau of Economic Analysis.

Table 6.2. States Ranked by Pollution-Intensity, average over 1987-2000

Rank	State	Toxic Emissions per Worker (pounds)	Rank	State	Toxic Emissions per Worker (pounds)
1	Nevada	249.49	25	Michigan	26.42
2	Utah	176.83	26	Delaware	26.26
3	Louisiana	166.61	27	Virginia	25.87
4	Montana	115.92	28	Nebraska	24.69
5	Arizona	98.15	29	Pennsylvania	24.50
6	Alabama	81.35	30	North Dakota	24.18
7	Mississippi	79.31	31	Oregon	22.88
8	West Virginia	78.87	32	Oklahoma	22.88
9	New Mexico	73.97	33	Illinois	22.34
10	Tennessee	66.88	34	Washington	21.47
11	Idaho	63.23	35	California	19.59
12	Indiana	62.43	36	Wisconsin	18.92
13	Wyoming	56.86	37	Florida	16.82
14	Arkansas	55.92	38	New Hampshire	14.84
15	Texas	49.83	39	South Dakota	13.97
16	South Carolina	47.20	40	Minnesota	13.63
17	Kentucky	40.15	41	Maryland	12.07
18	Ohio	38.67	42	Rhode Island	9.23
19	Maine	35.56	43	Connecticut	9.10
20	North Carolina	33.01	44	New Jersey	8.99
21	Georgia	31.64	45	Colorado	7.59
22	Kansas	30.79	46	Massachusetts	7.53
23	Missouri	30.22	47	New York	7.38
24	Iowa	26.57	48	Vermont	2.68

Source: Toxic Release Inventory and Bureau of Economic Analysis.

Table 6.3. States Ranked by Mobility of Industry, average over 1985-1996

Rank	State	Plant Fixed Costs	Rank	State	Plant Fixed Costs
1	West Virginia	0.1876	25	North Carolina	0.1551
2	Louisiana	0.1704	26	Minnesota	0.1549
3	South Carolina	0.1693	27	Georgia	0.1544
4	Delaware	0.1662	28	Tennessee	0.1541
5	Indiana	0.1657	29	Oregon	0.1533
6	Wyoming	0.1652	30	Connecticut	0.1532
7	New Jersey	0.1648	31	Arkansas	0.1526
8	Pennsylvania	0.1642	32	Mississippi	0.1521
9	New Mexico	0.1626	33	Montana	0.1520
10	Alabama	0.1622	34	California	0.1517
11	Texas	0.1620	35	Maine	0.1515
12	Ohio	0.1615	36	Kentucky	0.1509
13	New Hampshire	0.1614	37	Florida	0.1502
14	Oklahoma	0.1599	38	Idaho	0.1498
15	Illinois	0.1589	39	Colorado	0.1495
16	Arizona	0.1583	40	Virginia	0.1485
17	Vermont	0.1575	41	Michigan	0.1482
18	Nevada	0.1571	42	Missouri	0.1481
19	Utah	0.1569	43	New York	0.1480
20	Maryland	0.1566	44	North Dakota	0.1474
21	Rhode Island	0.1565	45	Nebraska	0.1474
22	Wisconsin	0.1564	46	South Dakota	0.1471
23	Iowa	0.1562	47	Kansas	0.1464
24	Massachusetts	0.1558	48	Washington	0.1453

Note: Data come from Bartelsman, et al. (2000) NBER-CES Manufacturing Industry Database and the Bureau of Economic Analysis. Plant fixed costs are real capital structures, normalized by the total value of industry shipments (weighted by size of each industry in terms of gross state product divided by the total gross state product of all manufacturing industries).

Table 6.4 Strategic Interaction of State Enforcement Behavior (State Susceptibility, Size of the Economy), 1985-2000

	DV = Inspections			DV = Enforcement Actions		
	Contiguous (1)	*BEA* (2)	*Crone* (3)	*Contiguous* (4)	*BEA* (5)	*Crone* (6)
Clean Air Act						
Competitors' enforcement for states with GSP *below* national average (δ_0)	-0.249 (0.907)	1.628** (0.513)	0.457 (0.309)	0.290 (0.283)	0.745** (0.230)	1.019** (0.200)
Competitors' enforcement for states with GSP *above* national average (δ_1)	0.295 (0.697)	1.824** (0.575)	1.201* (0.514)	-0.436 (0.301)	0.740 (0.467)	-0.075 (0.369)
Clean Water Act						
Competitors' enforcement for states with GSP *below* national average (δ_0)	1.451** (0.318)	0.691** (0.170)	0.387* (0.178)	1.078* (0.519)	1.089** (0.380)	0.578 (0.300)
Competitors' enforcement for states with GSP *above* national average (δ_1)	1.119** (0.334)	0.408 (0.357)	-0.044 (0.571)	0.761 (0.880)	1.218* (0.501)	-0.146 (0.484)
RCRA						
Competitors' enforcement for states with GSP *below* national average (δ_0)	0.387 (0.253)	0.468* (0.233)	0.837** (0.186)	0.538 (0.565)	0.860** (0.259)	1.122** (0.358)
Competitors' enforcement for states with GSP *above* national average (δ_1)	0.003 (1.785)	-1.289 (0.912)	0.156 (0.839)	0.057 (0.933)	0.562 (0.418)	-0.208 (0.934)

Coefficients are elasticities. $n = 752$ (47 states x 16 years) for CAA; $n = 593$ (includes state-year combinations for states with NPDES authorization only) for CWA; $n = 657$ (includes state-year combinations for states with RCRA Subtitle C authorization only) for RCRA. Robust standard errors in parentheses. **Statistically significant at the .01 level; *statistically significant at the .05 level. Coefficients for state and time fixed effects, Democratic governor, Democratic legislature, state ideology, unemployment, fiscal health, manufacturing GSP (and mining GSP in CWA models), number of facilities, per capita income, population, population density, and urbanization are not reported.

Table 6.5 Strategic Interaction of State Enforcement Behavior (State Susceptibility, Pollution-Intensity of the Economy), 1987-2000

	DV = Inspections			DV = Enforcement Actions		
	Contiguous (1)	*BEA* (2)	*Crone* (3)	*Contiguous* (4)	*BEA* (5)	*Crone* (6)
Clean Air Act						
Competitors' enforcement for states with pollution-intensity *above* national average (δ_0)	-1.340 (0.766)	0.730 (0.600)	0.438 (0.468)	-0.310 (0.323)	0.486 (0.249)	0.958** (0.361)
Competitors' enforcement for states with pollution-intensity *below* national average (δ_1)	-0.945 (0.693)	0.809 (0.651)	1.680 (0.941)	-0.005 (0.270)	0.550* (0.243)	1.564** (0.564)
Clean Water Act						
Competitors' enforcement for states with pollution-intensity *above* national average (δ_0)	1.253* (0.609)	0.623** (0.213)	0.475* (0.195)	0.827 (0.765)	0.484 (0.362)	0.673 (0.366)
Competitors' enforcement for states with pollution-intensity *below* national average (δ_1)	1.726** (0.484)	1.122** (0.250)	0.927** (0.231)	0.806* (0.341)	0.530 (0.393)	1.102* (0.436)
RCRA						
Competitors' enforcement for states with pollution-intensity *above* national average (δ_0)	0.617 (0.631)	-3.007 (2.357)	1.517* (0.650)	1.726 (1.978)	-0.050 (0.685)	0.877 (0.510)
Competitors' enforcement for states with pollution-intensity *below* national average (δ_1)	0.525* (0.262)	0.356 (0.390)	0.214 (0.332)	1.286 (0.756)	0.778** (0.268)	0.610 (0.341)

Coefficients are elasticities. $n = 658$ (47 states x 14 years) for CAA; $n = 525$ (includes state-year combinations for states with NPDES authorization only) for CWA; $n = 616$ (includes state-year combinations for states with RCRA Subtitle C authorization only) for RCRA. Robust standard errors in parentheses. **Statistically significant at the .01 level; *statistically significant at the .05 level. Coefficients for state and time fixed effects, Democratic governor, Democratic legislature, state ideology, unemployment, fiscal health, manufacturing GSP (and mining GSP in CWA models), number of facilities, per capita income, population, population density, and urbanization are not reported.

Table 6.6 Strategic Interaction of State Enforcement Behavior (State Susceptibility, Capital Mobility of the Economy), 1985-1996

	DV = Inspections			DV = Enforcement Actions		
	Contiguous (1)	*BEA* (2)	*Crone* (3)	*Contiguous* (4)	*BEA* (5)	*Crone* (6)
Clean Air Act						
Competitors' enforcement for states with capital mobility *above* national average (δ_0)	1.033* (0.495)	1.210* (0.581)	0.833** (0.254)	0.140 (0.556)	-0.237 (0.648)	0.255 (0.407)
Competitors' enforcement for states with capital mobility *below* national average (δ_1)	1.020* (0.453)	1.200* (0.537)	0.759 (0.421)	0.266 (0.440)	0.239 (0.434)	0.744* (0.351)
Clean Water Act						
Competitors' enforcement for states with capital mobility *above* national average (δ_0)	-0.376 (0.671)	0.280 (0.571)	-0.049 (0.336)	0.044 (0.495)	0.880* (0.400)	-0.201 (0.656)
Competitors' enforcement for states with capital mobility *below* national average (δ_1)	0.025 (0.488)	0.456 (0.362)	-0.101 (0.247)	-0.053 (0.487)	0.907* (0.400)	0.909 (0.588)
RCRA						
Competitors' enforcement for states with capital mobility *above* national average (δ_0)	-0.120 (0.658)	2.023 (1.419)	1.076** (0.353)	0.101 (0.794)	-0.636 (0.813)	1.049** (0.381)
Competitors' enforcement for states with capital mobility *below* national average (δ_1)	1.415 (0.928)	-0.170 (1.064)	0.600 (0.367)	0.408 (1.355)	0.721 (0.736)	0.842* (0.364)

Coefficients are elasticities. $n = 564$ (47 states x 12 years) for CAA; $n = 431$ (includes state-year combinations for states with NPDES authorization only) for CWA; $n = 473$ (includes state-year combinations for states with RCRA Subtitle C authorization only) for RCRA. Robust standard errors in parentheses. **Statistically significant at the .01 level; *statistically significant at the .05 level. Coefficients for state and time fixed effects, Democratic governor, Democratic legislature, state ideology, unemployment, fiscal health, manufacturing GSP (and mining GSP in CWA models), number of facilities, per capita income, population, population density, and urbanization are not reported.

Table 6.7. Strategic Interaction of State Enforcement Behavior (State Susceptibility, Size of the Economy), 1985-2000

	DV = Inspections			DV = Enforcement Actions		
	Contiguous (1)	*BEA* (2)	*Crone* (3)	*Contiguous* (4)	*BEA* (5)	*Crone* (6)
Clean Air Act						
Competitors' enforcement for states with GSP *below* competitors' average (δ_0)	0.447 (0.662)	1.389* (0.582)	0.632 (0.366)	0.083 (0.291)	0.660** (0.204)	1.344** (0.266)
Competitors' enforcement for states with GSP *above* competitors' average (δ_1)	0.151 (0.939)	2.262* (0.902)	1.157 (0.816)	0.436 (0.489)	0.302 (0.556)	-0.464 (0.529)
Clean Water Act						
Competitors' enforcement for states with GSP *below* competitors' average (δ_0)	1.383** (0.304)	0.712** (0.175)	0.256 (0.343)	1.542 (1.211)	0.776 (0.432)	0.402 (0.332)
Competitors' enforcement for states with GSP *above* competitors' average (δ_1)	1.875** (0.673)	0.770 (0.433)	0.874 (0.692)	1.366* (0.555)	1.180** (0.391)	0.117 (0.565)
RCRA						
Competitors' enforcement for states with GSP *below* competitors' average (δ_0)	0.316 (0.343)	0.795** (0.208)	0.916** (0.229)	0.389 (0.494)	0.953** (0.334)	1.202** (0.456)
Competitors' enforcement for states with GSP *above* competitors' average (δ_1)	3.701 (2.257)	-1.054 (1.018)	0.357 (0.625)	0.411 (1.351)	0.590 (0.398)	0.273 (0.728)

Coefficients are elasticities. $n = 752$ (47 states x 16 years) for CAA; $n = 593$ (includes state-year combinations for states with NPDES authorization only) for CWA; $n = 657$ (includes state-year combinations for states with RCRA Subtitle C authorization only) for RCRA. Robust standard errors in parentheses. **Statistically significant at the .01 level; *statistically significant at the .05 level. Coefficients for state and time fixed effects, Democratic governor, Democratic legislature, state ideology, unemployment, fiscal health, manufacturing GSP (and mining GSP in CWA models), number of facilities, per capita income, population, population density, and urbanization are not reported.

Table 6.8 Strategic Interaction of State Enforcement Behavior (State Susceptibility, Pollution-Intensity of the Economy), 1987-2000

	DV = Inspections			DV = Enforcement Actions		
	Contiguous (1)	*BEA* (2)	*Crone* (3)	*Contiguous* (4)	*BEA* (5)	*Crone* (6)
Clean Air Act						
Competitors' enforcement for states with pollution-intensity *above* competitors' average (δ_0)	-1.898 (0.986)	-0.281 (1.041)	1.115 (0.571)	1.071 (0.637)	-0.057 (0.532)	1.080** (0.414)
Competitors' enforcement for states with pollution-intensity *below* competitors' average (δ_1)	-1.582 (0.875)	0.205 (0.769)	0.722* (0.327)	0.495 (0.493)	0.731 (0.574)	0.907** (0.270)
Clean Water Act						
Competitors' enforcement for states with pollution-intensity *above* competitors' average (δ_0)	1.902** (0.535)	0.537 (0.376)	0.800* (0.350)	0.893** (0.328)	0.659 (0.391)	-1.563 (2.363)
Competitors' enforcement for states with pollution-intensity *below* competitors' average (δ_1)	1.742** (0.486)	0.875** (0.201)	0.713** (0.190)	0.788* (0.321)	0.512 (0.340)	0.286 (0.778)
RCRA						
Competitors' enforcement for states with pollution-intensity *above* competitors' average (δ_0)	-0.360 (1.519)	2.024* (0.896)	0.401 (0.611)	0.974* (0.410)	2.502 (2.112)	1.475 (0.779)
Competitors' enforcement for states with pollution-intensity *below* competitors' average (δ_1)	0.844 (0.652)	-0.463 (0.491)	0.915 (0.596)	1.093* (0.477)	-0.176 (0.715)	0.182 (0.453)

Coefficients are elasticities. $n = 658$ (47 states x 14 years) for CAA; $n = 525$ (includes state-year combinations for states with NPDES authorization only) for CWA; $n = 616$ (includes state-year combinations for states with RCRA Subtitle C authorization only) for RCRA. Robust standard errors in parentheses. **Statistically significant at the .01 level; *statistically significant at the .05 level. Coefficients for state and time fixed effects, Democratic governor, Democratic legislature, state ideology, unemployment, fiscal health, manufacturing GSP (and mining GSP in CWA models), number of facilities, per capita income, population, population density, and urbanization are not reported.

Table 6.9 Strategic Interaction of State Enforcement Behavior (State Susceptibility, Capital Mobility of the Economy), 1985-1996

	DV = Inspections			DV = Enforcement Actions		
	Contiguous (1)	*BEA* (2)	*Crone* (3)	*Contiguous* (4)	*BEA* (5)	*Crone* (6)
Clean Air Act						
Competitors' enforcement for states with capital mobility *below* competitors' average (δ_0)	1.117* (0.448)	1.204* (0.538)	0.836** (0.301)	0.904 (0.503)	1.004* (0.403)	1.246* (0.594)
Competitors' enforcement for states with capital mobility *above* competitors' average (δ_1)	1.236* (0.479)	1.226* (0.608)	0.820** (0.273)	1.119 (0.659)	1.728** (0.633)	0.376 (0.495)
Clean Water Act						
Competitors' enforcement for states with capital mobility *below* competitors' average (δ_0)	0.648 (0.339)	0.649** (0.219)	-0.368 (0.313)	0.125 (0.503)	0.999 (0.532)	0.592 (0.527)
Competitors' enforcement for states with capital mobility *above* competitors' average (δ_1)	0.366 (0.423)	0.694 (0.445)	-0.109 (0.279)	-0.149 (0.522)	0.431 (0.535)	-0.007 (0.478)
RCRA						
Competitors' enforcement for states with capital mobility *below* competitors' average (δ_0)	0.392 (0.324)	1.312** (0.457)	0.536 (0.519)	0.087 (0.731)	1.365 (0.960)	0.934* (0.448)
Competitors' enforcement for states with capital mobility *above* competitors' average (δ_1)	-0.246 (0.741)	0.174 (0.547)	1.253* (0.635)	-0.010 (0.634)	0.175 (0.628)	0.991* (0.409)

Coefficients are elasticities. $n = 564$ (47 states x 12 years) for CAA; $n = 431$ (includes state-year combinations for states with NPDES authorization only) for CWA; $n = 473$ (includes state-year combinations for states with RCRA Subtitle C authorization only) for RCRA. Robust standard errors in parentheses. **Statistically significant at the .01 level; *statistically significant at the .05 level. Coefficients for state and time fixed effects, Democratic governor, Democratic legislature, state ideology, unemployment, fiscal health, manufacturing GSP (and mining GSP in CWA models), number of facilities, per capita income, population, population density, and urbanization are not reported.

Chapter 7. State Environmental Managers Survey

Introduction

The past three chapters have established through state-level data analysis that states do engage in regulatory competition, and that this behavior does at times lead them to reduce their environmental protection effort. A limitation of this type of empirical examination is that studying aggregate level phenomena presumes motivations of state regulators and it does not enable one to discern the mechanisms operating at the state level. To address these issues, I conducted the State Environmental Managers Survey (SEMS). The survey asked senior officials working in state environmental agencies about their attitudes on the relationship between environmental regulation and economic development and about the importance (or lack thereof) of interstate economic competition on state regulatory practices.

The purpose of the SEMS is twofold. First, the elite-level surveys will help validate the aggregate data analysis. If states do, in fact, respond to the regulatory behavior of their economic competitors, we should observe some evidence of this in their attitudes and in their views about the influences on regulatory decision-making in their agency. For example, state regulators should perceive that there is a relationship between their agency's regulatory practices and industry investment decisions. Additionally, regulators should believe that their agencies at times modify their behavior in response to these concerns. Last, if states are responding to their competitors, they should have knowledge about their competitors' behavior. That is, an underlining presumption of interstate influence (whether from competitive pressures or otherwise) is state regulators know what is happening in other states. These expectations comprise the hypotheses I outlined in Chapter 2.

The second purpose of the SEMS is to elucidate the mechanisms of state responsiveness. The aggregate level data analysis does not speak to how state responsiveness works. Do state regulators respond directly in accord with their own view of economic competition? Or, alternatively, is state regulatory responsiveness influenced by elected officials, such as governors and state legislators, or by the lobbying of business-oriented interest groups? Answers to these questions will lead to a better understanding of how regulatory competition

manifests itself within the decision-making of state governments.

The balance of this chapter is organized as follows. In section 7.1, I review the existing survey work that has been conducted on this topic. In section 7.2, I describe the design and administration of the SEMS and provide a profile of the survey respondents. In section 7.3, I present the results of the SEMS, and discuss the implications for hypotheses regarding regulatory competition. Last, in section 7.4, I explore the mechanisms of state responsiveness.

7.1 Previous Survey Research

Some survey research has explored the relationships between regulation, economic development, and environmental protection. There are two main streams of this work, one that focuses on the perceptions of corporate executives and the other on the perceptions of the public.

Over the past couple of decades, a number of surveys have focused on the importance of environmental regulation in private sector investment decisions (Manufacturers Alliance/MAPI, 2001; Davis, 1992; Lyne, 1990; Calzonetti and Walker 1988; Epping, 1986; Stafford, 1985; Barker, 1983; Schmenner, 1982).[1] These studies asked corporate executives and other business officials about the factors important to industry (re)location decisions. Typically, these surveys asked business leaders to either name or rank the factors they considered to be the most important when deciding where to locate a new facility. The logic of this line of questioning comes from analyses of investment decision-making, which have found that site selection typically comes after companies have decided on the basic size and type of a new facility.[2] That is, factors such as environmental regulation are likely to emerge during the site selection process, rather than during the initial decision of whether to construct a new facility.

Stafford (1985) is a representative survey of this type. His survey asked corporate executives (n=104) involved in the siting decision of a new manufacturing branch facility about the importance of environmental regulation in their decision-making. In the first part of the

[1] A few similar surveys were conducted in the 1960s, but these did not include questions about environmental regulations (e.g., Mueller and Morgan, 1962; Greenhut and Colberg, 1962)

[2] Kieschnick (1978) argues that "environmental regulations are much more likely to play a role in the selection of specific sites within a region previously selected for other reasons."

questionnaire, Stafford invited open-ended responses and asked the respondents to identify major location factors. In the second part of the questionnaire, Stafford asked the corporate executives to rank in the order of importance numerous factors in location decisions. Responses to the survey (as well as a number of interviews) indicated that environmental regulations were far down on a list (ranked 11th) of factors most important to location decisions.

Others similar surveys also found scarce evidence that environmental regulations (e.g., air quality standards, environmental permitting requirements) played more than a marginal role in industrial location decisions. Respondents in a couple of surveys indicated that environmental regulations were significant factors (Davis, 1992; Lyne 1990), but, by in large, business officials typically have pointed to market accessibility and labor costs as the main drivers of industrial location decisions.

A second stream of survey research consists of public opinion polls.[3] Gallup and other organizations have over the years carried out numerous public opinion surveys on environmental topics, and studies such as the General Social Survey (GSS), the American National Election Study (ANES), and the DDB Life Style study (DDB), have often included environmental questions in their batteries. With respect to the specific topic of the relationship between economic development and environmental protection, several organizations have included questions pertaining to perceptions about the burden of environmental regulation on business.

First, the ANES has recently included the following question:

> Generally speaking, some people think we need much tougher government regulations on business in order to protect the environment. (Suppose these people are at one end of the scale, at point 1.) Other people think that current regulations to protect the environment are already too much of a burden on business. (Suppose these people are at the other end of the scale, at point 7.) And, of course, some other people have opinions somewhere in between, at points

[3]Guber (2003) has carried out the most comprehensive analysis of public opinion on environmental matters.

2, 3, 4, 5, and 6. Where would you place yourself on this scale?

In essence, this question asks respondents to identify where they stand along a *jobs v. environment* continuum.[4] The ANES included this question on three successive biennial surveys, from 1996-2000. Table 7.1 reports the results for each survey, as well as the cumulative results when combining the responses from the three surveys. The fundamental finding from these opinion polls is that the public does not think there is too much environmental regulation. The mean response to this question was 3.42, 3.10, and 3.14 in 1996, 1998, and 2000, respectively, with an overall mean response of 3.25 when the responses across the surveys are combined. In other words, on average, the public desires environmental protection even if it comes at the expense of some jobs.

These results, however, do not tell us much about the intensity of these preferences or the overall saliency of environmental issues when it comes to voting and other political behavior. Guber's (2003) analysis of the intensity of the responses to the above question from the 1996 ANES survey led her to conclude that: "Americans may be concerned about the environment, but many are ambivalent and unresolved about how strongly those issues should be addressed when other values enter into the equation." Moreover, there is little evidence of much environmental issue voting, at least at the national level. In addition to low issue salience, Guber (2001) argues that environmental issues do not factor much into national electoral politics because of small perceived differences between candidates on environmental policy and the tendency of environmental issues to cut across traditional cleavages. A recent poll found that environmental issues played a major role in the voting of only 22% of Americans (Lilliard, 2005).

The Gallup Organization and Princeton Survey Research Associates have asked similar questions to the one included in the ANES. Gallup, for example, asked the following question in two 1992 surveys, and in annual surveys from 2000 through 2004:

With which one of these statements about the environment and the economy

[4]The GSS and DDB studies have asked similar questions. The GSS has asked respondents to indicate their level of agreement with the following statement: "We worry too much about the future of the environment, and not enough about prices and jobs today." The DDB has asked respondents to indicate the extent of their agreement with a similar statement: "I support pollution standards even if it means shutting down some factories."

> do you most agree – protection of the environment should be given priority, even at risk of curbing economic growth or economic growth should be given priority, even if the environment suffers to some extent?

Similarly, Princeton Survey Research Associates asked this question several times between 1994 and 2004:

> (Now I am going to read a few more pairs of statements. Again, just tell me whether the first statement or the second statement comes closer to your own views – even if neither is exactly right.)...Stricter environmental laws and regulations cost too many jobs and hurt the economy. Stricter environmental laws and regulations are worth the cost.

Figure 7.1 presents responses to the Gallup and the Princeton surveys.[5] Consider the responses to Gallup's question. As is shown in the left panel, the public has consistently indicated that more priority should be given to environmental protection relative to economic growth. When Gallup asked this question twice in 1992 and again in 2001, about 60% of the public expressed the viewpoint that environmental protection should be given more priority. In the four most recent surveys, the public has continued to express this opinion, but the gap between the responses has narrowed quite a bit. The results from the Princeton question are presented in the right panel of Figure 7.1. What is most striking about these results, is that the public's responses to this question have remained essentially constant over the past decade. Princeton has asked this question on seven separate instances, and the public has consistently indicated that environmental regulations are worth the cost of jobs, at about a 60% level. The responses to the Gallup and the Princeton questions are in concert with the results from the ANES surveys.

While these surveys of corporate executives and the public are revealing, more salient for my study are the attitudes of the public officials in state agencies directly responsible for determining state regulatory policies. Scholars have surveyed state bureaucrats to answer a number of important questions, including the extent to which political elites influence agency

[5]The source for these surveys is the Roper Center for Public Opinion Research.

behavior (Cho, et al. 2004; Waterman, et al. 2004) and the "regulatory styles" of agency officials (Hunter and Waterman, 1996). With respect to the central issues of interest for this study, I am aware of only a single survey (Engel, 1997) that asked the right set of questions to the right people.

The purpose of Engel's study was to gain some understanding of whether states relax their environmental standards in an effort to attract or retain industry. To do so, she conducted a survey of several different sets of individuals involved in (or whom she thought might influence) state environmental standard-setting: environmental regulators, legislators, economic development officials, chamber of commerce officials, and leaders of environmental advocacy organizations. Engel aimed to address a puzzle facing the race to the bottom literature. At the time of her study, the consensus in the literature was that environmental standards were not important to industry location, which suggested a lack of a race to the bottom (as discussed in Chapter 2, the consensus in the current literature is that industry location decisions do, in fact, respond to interstate differences in environmental regulatory stringency). Engel rightfully argued that there remained the possibility that states did not understand or believe that environmental standards were unimportant to private sector investment decisions, thereby raising the possibility that state regulators acted on the belief that they did matter. In other words, if regulators were acting on their misunderstanding of industry location decision-making, it created the possibility that states were engaged in race to the bottom type behavior and that state regulators were lowering their environmental standards in response to interstate economic competition.

The survey questionnaire Engel designed consisted of four categories of questions. The first set asked respondents to assess the importance of environmental standards in industry location decisions. Second, Engel asked respondents whether concerns about industry response to environmental standards had led their agency to modify their regulatory practices. Third, respondents were asked about their familiarity with other states' environmental standards. Last, Engel asked respondents about the relationship between standards in their state and other states. These are precisely the right questions to ask, as they speak directly to the race to the bottom argument.

The primary results from the Engel survey are as follows. Considering first the responses from the state environmental regulators, she found that over half of the respondents thought that environmental regulations were a fairly or very important factor in industry location decisions, although environmental regulations ranked last of out five factors.[6] More importantly, a sizeable minority of the regulators indicated that concerns about industry (re)location had led their state to weaken their environmental protection efforts to some degree, by taking action such as relaxing or not implementing and/or enforcing a standard. Engel inferred from these results that, at times, state environmental agencies weakened their environmental standards due to concerns about attracting and retaining industry, and concluded that this was evidence consistent with a race to the bottom in state-level environmental protection.

The second part of Engel's survey addressed additional implications of the race to the bottom argument. For example, Engel asked respondents about their familiarity with regulations and regulatory practices in other states. Generally speaking, across the different groups in the sample, respondents claimed to have fairly good knowledge about other state's environmental quality standards, and particularly whether they were more, less, or about equivalent in stringency. As a follow up question, Engel inquired about the importance of the relative stringency of other states' standards. Her finding here was that regulators thought it most important to have standards of about the same stringency as neighbors, which indicates their desire for uniformity across the country. Although these results are consistent with the idea that states may want to maintain a level playing field, they do not suggest that state regulators think it is important to relax their regulatory practices to gain a competitive advantage over economic competitors.

A noteworthy component of Engel's survey is that it enabled at least some comparisons between regulators and individuals representing other groups involved or potentially influential in state environmental regulation. The sample sizes, however, were quite small making it difficult to say too much about differences in perceptions among these groups, but it is

[6]Other factors included proximity of transportation, nature of labor force, tax incentives/subsidies, and proximity to natural resources.

possible to reach some modest conclusions.[7] For example, while 88% of the regulators indicated that concerns about potential impacts on industry played a role in agency regulatory practices, all 23 respondents from environmental groups agreed with this statement, while only 62% of state legislators agreed. More revealing, perhaps, are the differences in opinion about which regulatory practices change due to concerns about their impacts on industry relocation. About 30% to 35% of the regulators responding to Engel's survey indicated that agency actions such as discouraging adoption of an environmental standard, reducing the level of information required in a permit, or levying a smaller civil or criminal penalty. However, 85% to 90% of environmental group representatives thought these regulatory practices were affected, as did comparatively more legislators, officials from economic development agencies, and representatives of chambers of commerce.

Although Engel's survey was well-constructed, the sample was limited. Engel focused on the top levels of state environmental agencies. More specifically, she surveyed the head administrators of state environmental agencies, state water pollution administrators, and state air pollution administrators. This first group consisted of political appointees, which raises the possibility that Engel received "political" rather than sincere responses.[8] Moreover, the total sample was very small, which makes statistical analysis difficult.[9] Finally, it is not clear that the officials at the highest level of these agencies are best-placed to know what is happening in terms of the day-to-day operations of the agency, and many of the key questions addressed in the survey require this type of knowledge.

7.2 State Environmental Managers Survey

To address the limitations of the Engel study, I conducted the SEMS. The primary purpose of my survey was to ask a similar, but I think improved set of questions from the Engel survey, to a much larger group of state regulators. In particular, as I explain further below, I targeted the survey to state regulators less overtly involved in partisan politics, but rather

[7]Engel received back 80 questionnaires from regulators, 24 from individuals in citizen environmental advocacy groups, 36 from legislators, 32 from officials in economic development agencies, and 31 from representatives of chambers of commerce.

[8]Through a guarantee of confidentiality, some of this concern may have been mitigated.

[9]Out of a potential 150 regulators (three per state), only 80 participated in Engel's study, with response rates to specific questions even smaller.

serving in positions in state environmental agencies in which they are directly responsible for managing major environmental programs. In this section of the chapter, I describe the design and administration of the survey and summarize the characteristics of the respondents.

7.2.1 Survey Design and Administration

I designed the survey to ask the senior managers about the following subjects: 1) the importance of environmental regulations (relative to other factors) in industry location decisions; 2) whether (and how) concerns about industry investment decisions influence their state agency's regulatory practices; 3) the degree of familiarity that state agencies have with other states' (particularly economic competitors) regulation, and the relative importance of other states' environmental regulations to their own state's environmental protection efforts; and 4) the degree to which interstate economic competition drives decision-making.[10] Although the basic subject of the questions I included in the SEMS mirror those included in Engel's study, the SEMS is not a mere replication. Most of the questions are either new or have significantly modified wording. In some cases, however, I deliberately replicated questions from the Engel study (and from other surveys) for the sake of making explicit comparisons. I discuss the details of question selection and wording below.

The sample for the SEMS consisted of regulators serving in the 50 state environmental agencies across the country. In creating the sample of potential respondents, I targeted specific levels of these agencies. In particular, I chose to concentrate on senior (career) managers rather than explicitly political (appointed) managers. The primary reason for this strategy was that I was interested in the perceptions and views of agency officials that were not, to the extent possible, confounded with partisan politics. In other words, I was not looking for an "official" response from the agency, but rather the personal attitudes and beliefs of experienced officials.[11]

Practically speaking, I identified respondents by examining each agency's organizational

[10]I would like to thank Steve Ansolabehere, Adam Berinsky, Liz Gerber, John Kennedy, Steve Meyer, and Charles Stewart for their suggestions on the survey instrument.

[11]I also did not include the political levels of the state agencies for a more pragmatic reason: I was concerned that if the political officials at the head of the agencies learned of the survey, they would instruct their staffs not to participate.

chart. Specifically, I compiled the name, title, and division for individuals in the second and third tiers of the state agencies (i.e., the two levels immediately beneath agency administrators). Second-tier officials typically included directors of major divisions, such as divisions of air quality. Third-tier officials included directors of major offices or bureaus within these divisions. I also included managers of sections within these divisions specifically involved in permitting, standard-setting, and implementation and enforcement activities (as inferred from either division names or position title names), since they are in positions to understand the issues I am interested in this study. My sampling strategy, while cost-efficient, did have some limitations. States provide different levels of information about their agency structure and personnel on their public websites. Since I was limited to this information, there was some inconsistency across the 50 states in the number of individuals ultimately included in the sample due, not to agency structure, but to information accessibility.[12]

This method of selection proved successful in limiting the sample to career, rather than political managers. Of the 498 respondents, 460 (over 92%) identified themselves as career officials. Once I had identified the respondents, I then collected contact information (email addresses and phone numbers) for each from information available directly on the agency's website, from online state directories, or, when necessary, from individual-level internet searches.[13]

The survey was administered through the internet under a contract with the Indiana University Center for Survey Research (IUCSR).[14] Similar to mail-based surveys, the web-based format eliminated the potential of interviewer bias and provided the confidentiality required to enable the agency officials to respond to questions that were potentially sensitive in nature. The web-based format also provided the additional benefit of permitting completion of the survey at time convenient for the respondent.

To improve the chances of a high response rate, the survey was administered using Dillman's (1978, 2000) Total Design Method, with some minor modifications due to the web-

[12]Resource limitations inhibited an effort to comprehensively examine other sources for this information.

[13]I was unable to find email addresses for a small number of individuals, and of the 1494 email addresses compiled, 22 proved to be inaccurate or obsolete.

[14]I would like to thank Andy Davis, Donna Hackney, John Kennedy, Kellie McGiverin-Bohan, and the rest of the staff at the IUCSR for their help with the design and management of the project.

based format. An initial announcement email was sent to respondents describing the nature of the project. A few days following this announcement, an invitation email was sent to the respondents reiterating the purpose of the survey, and containing login and password information for the web-based interface. This message made clear that participation was voluntary and that all responses would be kept confidential. Approximately two weeks later, a follow-up email was sent to those individuals that had not yet responded to the survey (excluding those individuals (n=106) that had explicitly indicated to us that they wanted to decline participation), asking for their participation.[15] The survey was in the field for about six weeks in total (during June and July 2005).[16]

The SEMS yielded a response rate of approximately 34% (498 of 1459 potential respondents).[17] The response rate is somewhat low, but it is on par with that of some other recent surveys of government agency officials (e.g., Waterman, et al. 2004; Cho and Wright, 2004).

Table 7.2 shows the number of respondents, state-by-state. Although I received responses from senior managers in all 50 states, the response rate across the states varied significantly, from as high as 61% in Massachusetts to as low as less than 10% in New York. The mean response rate per state was about 32%. As indicated above, the number of potential respondents in each state varied due to differences in agency organizational structure and in information availability from the state environmental agency websites.

7.2.2 Profile of Respondents

The government officials surveyed in the SEMS include senior managers from a diversity of offices in state environmental agencies. One simple way to classify the types of problems the senior managers manage is to categorize their division and offices by environmental media (i.e., air, water, land and waste). Consistent with the manner in which environmental issues are generally regulated and the federal Environmental Protection Agency (EPA) is organized, most state agencies are organized by environmental media. Table 7.3 presents the breakdown

[15]Resource limitations prevented sending out a second reminder notice.

[16]The survey was administered in a second wave for respondents in Vermont during September 2005, due to an inadvertent omission of respondents from this state during the first wave.

[17]Another 51 respondents partially completed the survey, but I elected to exclude their responses from those reported below.

of the respondents into four categories: air, water, land and waste, and other. The other category includes senior manager responsible for issues regarding multiple environmental media and/or areas not otherwise easily categorized (e.g., policy, enforcement, etc.).

Another way to classify the positions of the senior managers is in terms of the types of regulatory activities they supervise. The SEMS asked respondents to identify the first, second, and third most frequent actions their office uses to support its mission. As presented in Table 7.4. The most frequent actions utilized by the offices involved permit writing (37.7%), compliance monitoring (22.4%) and standard-setting (11.2%). Compliance assistance, enforcement, and remediation/reclamation were mentioned less often as the most frequent action, but the offices do clearly utilize these actions as well.

To better understand the perceptions of the state regulators, I included a number of background questions to collect information on the regulators' demographic and socioeconomic characteristics and their political and environmental attitudes. These background questions both enable me to create a profile of the respondents, as well as to control for potentially confounding factors when analyzing the respondents answers to the substantive questions in the analyses that follow in this chapter.

Table 7.5 presents demographic information about the respondents. Survey participants were overwhelmingly male. About 80% of the individuals responding to the survey were male, compared to just 20% that were female. The individuals as a group had considerable experience at their state agencies. On average, the individuals had been in their current position for nearly 9 years, and had served in the agency in some capacity for an average of 19 years. The participants were also highly-educated. All but 2% of the respondents completed college, and over 55% had advanced degrees. Most of the regulators in the sample had degrees in engineering or in the natural sciences. Table 7.6 shows the breakdown of fields by discipline. In addition to education, another indication of the professional background of the respondents is income. About 70% of the respondents live in households with median incomes of $70,000 or more.

The regulators' political attitudes suggest that the individuals in the sample are more Democratic and more liberal than Republican and conservative. Of the 453 individuals that

responded to the question about their affiliation with a political party, 168 (37%) identified themselves as Democrats, 85 (19%) as Republicans, 141 (31%) as Independents,[18] and 5 as Other (1%). Forty-five individuals elected not to respond to this question.

In addition to asking the respondents about their affiliation with a political party, I also inquired about their political ideology, using the standard question from the ANES. Respondents were asked to place themselves on a 7-point scale of political values, ranging from "extremely liberal" (1) to "extremely conservative" (7). The mean response was 3.8 (standard deviation of 1.4), which suggests that the average respondent falls somewhere on the middle of the scale of political ideology. More informative is the distribution of political ideology. As shown in the left panel of Figure 7.2, the leftward skew of the distribution suggests that more regulators fall on the liberal, rather than the conservative, end of the scale.

There is no single measure of environmental ideology, but to gauge the regulators' general attitudes on environmental protection – particularly, the role of government regulation – I included in the SEMS the *jobs v. environment* question from the ANES described above. Although one could imagine a number of questions to assess an individual's environmental ideology, Berinsky and Rosenstone (1996) found the ANES question to best explain attitudes about environmental protection. Recall, this question asks respondents to place themselves on a 7-point scale in terms of whether they think tougher government regulations on business are necessary, or whether government regulations are already too much of a burden (and points in between). The mean response to this question was 3.3 (standard deviation of 0.99), which is slightly to the "more regulation" end of the 7-point likert scale. This, of course, is not terribly surprising result considering the primary mission of the agencies in which the respondents work is to protect the environment. The right panel of Figure 7.2 shows the distribution of the senior managers' responses to this question.

7.3 Responses to the State Environmental Managers Survey

In this section, I report and analyze the responses to the SEMS. I both test the hypotheses

[18]This sizeable number of Independents may also include individuals that did not want to reveal their party affiliation.

regarding regulatory competition that I outlined in Chapter 2, and explain individual-level variation in the survey responses.

7.3.1 How Important are Environmental Factors in Industrial Facility Location Decisions?

An empirical implication of regulatory competition theory is that state decision-makers believe that environmental regulation is associated with economic investment. For this reason, we should find some evidence that state regulators think that environmental regulations influence economic investment decisions. To get at this issue in the SEMS, I asked the senior managers about their perceptions about the factors industry considers important when making facility siting decisions. I included the following question in the SEMS:

> Companies consider a number of factors when making a decision about where to locate a new facility. Suppose a company in an industry regulated by your agency was deciding where in the United States to located a new facility. How important do you believe the company would consider the following factors: proximity to customers/markets, tax incentives and/or subsidies, labor costs and quality, environmental regulations, quality and proximity of transportation facilities, and proximity to natural resources/raw materials?[19]

Prior surveys of corporate executive officials and Engel's study of state environmental decision-makers have asked about similar factors. For each factor, respondents were asked to indicator whether it was "not a factor," "not too important a factor," "a fairly important factor," or a "a very important factor."

Table 7.7 presents the responses to this question, ranking each factor by the mean importance given to it by the respondents.[20] The senior managers ranked quality and proximity of transportation facilities ($\mu = 3.59$) and labor costs and quality ($\mu = 3.57$) as the most important factors in industrial siting decisions, followed in order by proximity to customers/markets ($\mu = 3.46$), tax incentives and/or subsidies ($\mu = 3.41$), and proximity to

[19]I specifically situated the siting decision in the context of the United States as a way to prevent (or, at least limit) respondents from answering in terms of international competition.

[20]The response "not a factor" was assigned a value of 1, the response "not too important a factor" was assigned a value of 2, etc.

natural resources and raw materials ($\mu = 3.27$). The senior managers, on average, ranked environmental regulation ($\mu = 2.91$) last – that is, as the least important of the six factors considered. Nevertheless, the regulators did collectively believe that environmental regulations are an important factor in siting decisions. Of the 474 respondents to this question, 339 (about 71%) indicated that environmental regulation was either a fairly or very important factor to industry in facility location decisions, where as only 1% indicated that it was not a factor at all.

These results compare quite well to responses by individuals involved in industrial site selection. As noted previously, when corporate executives and other business leaders involved in siting decisions have been asked similar questions, they typically rank environmental regulation below factors such as labor costs, proximity to markets, transportation infrastructure, and natural resources. These response are also quite similar to those given by the state regulators in Engel's survey.

Anticipating the state regulators would attach some importance to environmental regulation in industry investment decisions, I also included in the SEMS a question about the specific environmental factors the regulators think matter most to industry:

> Again, suppose a company in an industry regulated by your agency was deciding where in the United States to locate a new facility. How important do you believe this company would consider the following environmental factors: time/expense in obtaining permits, state officials' flexibility and willingness to help industry, stringency of written environmental standards, pollution control incentives, and stringency of environmental enforcement?

Engel included several of these response categories in her survey – time/expense in obtaining permits, state officials' flexibility and willingness to help industry, and stringency of written environmental standards. I also included pollution control incentives due to the presence these financial inducements to polluting industries in nearly all states as well as a separate category for environmental enforcement, since this is an area where states have considerable discretion (as discussed in detail in Chapter 3). Collectively, these factors constitute the

attributes of a state's environmental regulatory climate. The response options again were "not a factor," "not too important a factor," "a fairly important factor," or a "a very important factor."

I present the senior managers' rankings of these factors – again, based on the mean level importance given to each – in Table 7.8. The respondents clearly consider state officials' flexibility and willingness to help industry ($\mu = 3.06$) and time/expense in obtaining permits ($\mu = 3.06$) as the most important environmental factors to facility location decisions, followed in order by the stringency of written environmental standards ($\mu = 2.91$), pollution control incentives ($\mu = 2.73$), and the stringency of environmental enforcement ($\mu = 2.57$). At first thought, it might be surprising that written standards and the enforcement of these standards, rank third and fifth, respectively. However, even though they are ranked below the other factors, the respondents still indicated that they were important factors that industry considers. Seventy-four percent of the respondents indicated that written environmental standards were a fairly or very important factor, while 49% of respondents indicated the same for environmental enforcement.

The responses to these questions provide some leverage for testing the first hypothesis I outlined in Chapter 2 – that is, that state government officials perceive that economic investment responds to the stringency of environmental regulations. The fact that over 70% of the respondents indicated that environmental regulation was either a fairly or very important factor to industry in facility location decisions suggests that regulators do think that economic investment responds to environmental regulatory stringency, irrespective of the fact that they consider it is less important than other factors.

The degree of importance given environmental regulation in industry siting decisions does not seem to systematically vary by region of the country[21] or by the environmental media managed by the respondents' office. Cross-tabulations do not reveal much, and the associations are not statistically different than what we might expect to see by chance for region ($\chi^2 = 14.6, p = .10$) and for office ($\chi^2 = 8.2, p = .52$), respectively. The lack of

[21]I define region using a modification of the Bureau of Economic Analysis (BEA) classification. I combine the BEA's New England and Mideast regions to form a northeast region, the BEA's Great Lakes and Plains regions to form a midwest region, the BEA's Southeast and Southwest region to form a south region, and the BEA's Rocky Mountain and Far West regions to form a west region.

meaningful differences across regions and environmental media is confirmed by a oneway analysis-of-variance test, which fails to rule out equal means for region ($F = 1.1, p = .37$) and by the environmental media managed by the respondent's office ($F = 2.0, p = .12$).

In Table 7.9, I present results from regression models that seek to explain individual-level variation in the responses to these questions. The key question this analysis addresses is what factors help predict regulators' perceptions about the importance of environmental regulations in industry siting decisions. I report the results from five separate models. The first model uses the responses to the question above regarding the importance of environmental regulations to industry siting. The second model uses the responses to the same question, but only as it relates to the primary industry regulated by the respondent's office.[22] The third and fourth models use the responses to the question about how important different environmental factors are to siting decisions, and specifically the responses about written environmental standards and environmental enforcement. The responses to these questions are themselves positively and strongly correlated.[23] A coefficient of reliability suggests that these four items represent a single unidimensional measure (Cronbach's $\alpha = 0.82$), so I also estimated a model with a dependent variable that combines these four items into a single scale.

I estimate these models with ordered logit analysis, accounting for the ordinal structure of the dependent variables. I consider three sets of covariates: personal attributes, the region of the country the respondent works, and the environmental media managed by the respondents' office. (See Appendix A for a description of how I coded each variable, and for summary statistics.) The only consistently statistically significant predictor of how much importance a regulator believed environmental regulations have on industry siting decisions is political ideology. As would be expected, the more ideologically liberal a regulator, the less likely he/she believed that the environmental regulations had a significant effect on in-

[22] Although not discussed above, I also asked the questions about the factors important to industry site selection decisions in a slightly modified way, by asking the question in terms of "the primary industry" regulated by the respondent's office. The main reason for doing this was to capture differences across different parts of state agencies and across industry groups. Unfortunately, this approach did not produce workable results because most of the respondents indicated that their offices regulated several industries.

[23] For example, the Kendall Tau-b correlation coefficient between the responses to the first two questions is 0.59, and is 0.51 between the second two responses.

dustry decisions on where to locate a new facility in the United States. As a measure of the magnitude of political ideology, for a one standard deviation increase in ideology in a liberal direction, the odds of responding that environmental regulations is a significant factor in industrial site selection decreases by a factor of 0.77. Overall, most of the other variables were not statistically significant across the five models.

7.3.2 What Role do Concerns about Impacts to Industry Have on Regulatory Practices?

The next section of the SEMS asked a series of questions about how concerns about the impact of environmental regulatory actions on industry affect agency behavior.[24] The purpose of this line of inquiry was to assess if (and how) these concerns affected agency regulatory practices. Theories of regulatory competition suggest that state agencies confronted with interstate economic competition modify their regulatory practices. Recall from Chapter 2, I hypothesized that, if state environmental agencies are engaged in regulatory competition, we should find evidence that these agencies modify their regulatory activity in response to concerns that state environmental regulation has an effect on private sector investment decisions.

To examine this hypothesis, I closely replicated a question included by Engel in her survey, since it concisely gets to this issue.[25] The primary advantage of the SEMS is that the sample consists of individuals closely managing the regulatory actions themselves, rather than higher level agency officials less involved in the day-to-day operations of regulation. The question reads:

> How important a role has concern over potential impacts on industry played in your agency's actions in the following areas: discouraging or opposing adoption

[24] I began this part of the survey with a filtering question: "What kind of role has concern over potential impacts on industry played in your agency's actions, decisions, or policies?" The reason for the filtering is that, without it, the question would have to be worded in a way that assumes that the effect of environmental regulation is unidirectional – that is, deleteriously impacts industry. The formulation of the question might be problematic for some respondents that reject this premise altogether. Only 13 (less than 3%) of the respondents answered that concerns over potential impacts on industry played "no role" in agency actions, decisions, or policies.

[25] It is difficult to compare the SEMS results directly with those from the Engel survey. Engel asked whether concerns about impacts to industry played a role in the various environmental regulatory decisions, but did not differentiate between degrees of this role.

> of a more stringent environmental standard, [adopting or advocating adoption of a less stringent environmental standard], [granting or advocating granting of an environmental permit], [allowing or advocating allowing larger emissions or discharges], [delaying or advocating delay of a facility inspection], [dropping or advocating dropping of an environmental enforcement action], or [levying or advocating levying a smaller or lighter civil or criminal penalty for an environmental violation]?

For each response category, respondents were asked to answer "no role," "not too important a role," a fairly important role," or "a very important role." Moreover, I asked the respondents to evaluate with what frequency this concern affects their agency's actions: "frequently," "from time-to-time," "rarely," or "not applicable" (in cases where respondents indicated no role). One would assume that the senior managers responding to this question might be reluctant to acknowledge that they have personally curtailed regulatory actions due to concerns about their effects on industry. To address this potential bias, I stated the question in terms of the respondent's agency behavior, rather than their personal behavior. Moreover, to the extent that there remains a bias to under-report this behavior, it would lead to an understatement of the effect.

In Table 7.10, I rank the responses to this question by how important a role concerns about impacts to industry had in influencing agency behavior in each regulatory action. It is clear from the responses that, on average, concerns about the effects on industry lead to changes in standard-setting and permit granting more so than compliance monitoring and enforcement actions. Not only were the respondents more likely to assign greater magnitude to concerns about impacts with respect to these particular regulatory practices, but also to the frequency in which these concerns influenced decisions in these areas. Rankings aside, majorities or strong minorities of the respondents indicate that their agency's actions have been influenced by these concerns. For example, nearly 60% of the regulators responded that concerns about the impacts on industry played a role in the discouragement or opposition to adoption of a more stringent environmental standard, with 14% indicating a very important role. Over 40% of the respondents indicate that such concerns influenced agency decisions

to adopt a less stringent standard or to grant an environmental permit. These results speak directly to the hypothesis noted above. The evidence here suggests that, at least at times, state agencies weaken their environmental regulatory practices due to concerns about their effects on industry. However, these results should not be over-interpreted. The responses to these questions alone do not directly address whether the motivation for the changes in regulatory policy stem from actions taken in economic competitor states. I return to this issue below.

7.3.3 What do Regulators Know About the Regulatory Practices of Competitor States?

The next section of the survey inquired about the degree of familiarity that state regulators have with other states' regulation. In particular, I was interested in learning about the senior managers' knowledge about the regulatory practices of economic competitor states, and the relative importance of other states' environmental regulations to their own environmental protection efforts. An often overlooked – and untested – premise of regulatory competition theory is that regulators (or other state officials) have a firm understanding about other states' environmental regulations. Absent such knowledge, strategic regulatory behavior across economic competitor states is unlikely.

Assessing regulators' knowledge about other states is challenging. Engel attempted to address the issue directly by asking respondents about their likelihood of knowing about the stringency (relative to their own state and federal standards) of other states' environmental standards and permitting requirements. The responses to these questions provide some evidence that regulators were "fairly likely to know this," but it is difficult to know what this really means. In particular, a shortcoming of Engel's strategy was that she did not specifically ask the respondents about their familiarity with economic competitor states.[26]

I use a different approach in the SEMS. I began with a general question regarding how the respondents think their state ranks compared to other states in terms of environmental enforcement. I focus on environmental enforcement behavior in this question, rather than

[26]In another question, Engel did ask the respondents about their familiarity with "neighboring states," "states in the same geographic region," and "states outside geographic region," but in reference to anything in particular. While studies of regulatory competition, including mine, use these groups of states to define competitors, Engel did directly ask the respondents about which states they compete with.

environmental standards, since states have more discretion to modify enforcement effort than standards and because so many pollution control standards are set by the federal government. The exact wording of the question is as follows:

> Generally, states differ in their environmental enforcement (e.g., permitting requirements, frequency of inspections, responses to violations, etc.) Where would you say your state ranks in environmental enforcement compared to other states, or are you not sure?

The response categories to this question were: "much stronger than most," "a little stronger than most," "about the same as most," "a little weaker than most," "much weaker than most," and "not sure." The "not sure" category here is informative. If a large percentage of the seniors managers respond "not sure" to this question, it raises serious problems for regulatory competition theory, since ideas about races to the bottom (or races to the top, for that matter) presume that regulators are knowledgeable of, or at least have formed perceptions about, other states' regulatory practices.

The senior managers' responses to this question are shown in Table 7.11. The mode response (representing about a third of the responses) among the senior managers is that environmental enforcement ranks at about the same level as in most other states. Nearly 44% of the sample responded that enforcement efforts in their state rank as a little or much stronger than other states whereas only about 13% of the respondents indicated that their state's enforcement efforts were a little or much weaker than other states.[27] Only about 10% of the respondents indicated that they were "not sure" how their state's enforcement efforts ranked relative to other states.

There does seem to be some evidence that these responses systematically vary by the region in which the respondent works. The cross-tabulation, reported in Table 7.12, shows that the likelihood that a respondent indicated that his/her state's environmental enforcement effort was more (less) stringent than other states does seem to vary by region of the country ($\chi^2 = 32.4, p = .006$). Respondents in northeastern states were more likely to say that their

[27]There may be some bias in these results, namely a tendency of the officials not to rank their own state as doing less enforcement than other states.

environmental enforcement was more stringent than other states, whereas midwestern and western states were more likely to perceive their own environmental enforcement as weaker than other states. A oneway analysis of variance also suggests that there is a statistically significant difference across the means of these regions ($F = 3.06, p = .028$).

As a follow up question, I then asked the senior managers to specifically identify the states with the strongest (weakest), second strongest (weakest), third strongest (weakest), and fourth strongest (weakest) environmental enforcement efforts. The results shown in Table 7.13 are interesting for at least three reasons. First, the senior managers identified the states often considered to be environmental leaders and laggards. As far as the states identified for having the strongest enforcement, they included (in order) California, New York, New Jersey, Massachusetts, Oregon, and Washington. Interestingly, over 80% of the respondents that named California, indicated that it had the strongest enforcement of all the states. Regarding the states identified as having the weakest enforcement, they were (in order) Louisiana, Mississippi, Alabama, and Tennessee. Not surprisingly, states viewed as having the most stringent enforcement were either northeastern or west coast states, while the states viewed as having the least stringent enforcement were southern states. This coincides with widely-held perceptions of overall state environmental performance, but perceptions that are not necessarily true for environmental enforcement specifically as I show below.

Second, there is sizeable number of "not sure" responses, particularly when I asked the senior managers about the states with the weakest enforcement. More than 40% of the respondents failed to identify a state as having the strongest enforcement in the country, while 53% failed to identify a state as having the weakest enforcement. This high number of "not sure" responses may indicate limited familiarity with other states' regulatory practices, although this contradicts the low number from the previous question. It may also be the case that the state regulator's knowledge of other states' regulatory practices is limited to nearby states (e.g., states in the same EPA region), or states addressing similar issues.

Third, the state regulators perceptions about environmental enforcement are somewhat incongruous with actual environmental enforcement behavior (see Chapter 3). A correlational analysis between respondents' perceptions and the indicators I have created to mea-

sure state enforcement effort reveal that there is a disconnect. Across the six measures of state environmental enforcement that I consider in this study (the inspection rate and punitive action rate measures under the Clean Air Act (CAA), the Clean Water Act (CWA), and the Resource Conservation and Recovery Act (RCRA)), the Spearman's rho correlation (appropriate for assessing the correspondence of rank orderings) indicates a modest, but negative relationship. The Spearman rho coefficients range from about -0.13 to -0.39, although in one case – the correlation between perceptions and CWA inspections – the rho is positive ($r_s = .21$). This negative relationship remains between the average rank of the states enforcement behavior (mean across the six measures) and the respondents' perceptions of environmental enforcement stringency ($r_s = -.34$).

To further understand the nature of the regulators familiarity with other states, particularly with economic competitor states, I included another two-part question in the SEMS. The first part of the question asked:

> Again, thinking about the primary industry your office regulates, which three or four states does your state compete with most for companies and jobs in this industry?

After the respondent had named these states, I then asked them to indicate how these competitor states' environmental enforcement efforts compared to their own state's enforcement efforts. These results are shown in Table 7.14.

About 60% of the respondents in the sample were able to identify at least two states that compete for companies and jobs in their primary industry. Strong minorities of the respondents were also able to identify third and fourth economic competitor states, at levels of 49% and 36%, respectively. These results suggest broad knowledge about economic competitor states among the senior managers. As important, the senior managers were able to indicate how these states' environmental enforcement efforts compared to their own, as indicated by the low frequency of "not sure" responses; only about 14% to 16% of the respondents identified a competitor state, but then failed to indicate the relative stringency of this state's environmental enforcement. Similar to the response to the question discussed above

where I asked the respondents to compare their own environmental enforcement to all other states, the mode response here again is that the environmental enforcement is of about the same stringency. In addition, the respondents were more likely to indicate their economic competitor states had less, rather than more stringent, environmental enforcement.

The answers to this question serve another useful purpose for my study. One of the important modeling assumptions I made in previous analyses pertains to the definition of competitor states. As I have noted, there is no consensus in the literature about which states compete for economic investment. The responses here provide some insight. I can use the identification of competitor states by the regulators as a source of information to independently assess the definitions I have used – that is, contiguous neighbors, Bureau of Economic Analysis (BEA) regions, and Crone regions. In Table 7.15, I report the percent of the states that the regulators identified which fall into these three categories. For example, consider the case of Michigan. Of the states identified by the respondents as the main economic competitors for the primary industry their office regulates, about 53% were contiguous neighbors, about 67% were BEA regional neighbors, and about 56% were Crone regional neighbors. Although the results vary quite a bit across the states (this is, in part, a function of differences in sample sizes for each state), these data provide corroborative evidence that the definitions of competitors I have used in the study are valid.

7.3.4 Does Interstate Economic Competition Affect State Regulatory Practices?

The final series of questions I asked as part of the SEMS regarded the importance of interstate economic competition on state regulatory practices. I approached this issue with three questions.[28] The first question reads as follows:

> Thinking about the primary industry your office regulates, where does the most intense economic competition for firms in this industry come from: other firms within the state, firms in other states, firms in countries outside the United

[28] I prefaced these questions with the following statement: "The next set of questions again refers to your office, by which we mean your specific division or section within your agency." The reason for this introductory comment was to provide the respondents with a specific context and was part of an effort to enhance the internal validity of the responses.

States, or are you not sure?

The purpose of this question was to gain some understanding about how the senior managers viewed economic competition as it relates to the industries they regulate. The response to this question can be used as a measure of the extent to which interstate competition may be shaping the senior managers perceptions about the influences on state regulatory practices. Table 7.16 presents the results. The most frequent response from the senior managers was that most competition comes from firms within their own state (31%), followed closely by firms in other states (27%). Only about 17% of the senior managers thought that the most intense economic competition was coming from firms in countries outside of the United States. These responses did not statistically vary by region of the country from what we would expect to observe by chance ($\chi^2(9) = 12.8, p = .173$).

The second question then asked the senior managers about the relationship between environmental standards and industry competitiveness. The question reads:

> Again, thinking about the primary industry your office regulates, how much of an effect would relaxing the environmental standards for companies in this industry have in improving their competitiveness compared to similar companies operating in other states?

The responses to this question, shown in Table 7.17, indicate that a majority of the respondents think that relaxing environmental standards would lead to an improvement in the competitiveness of in-state businesses. Approximately 55% of the respondents indicated that relaxing standards would have a positive effect on the competitiveness of companies in their state relative to companies in other states, and nearly 12% of the respondents indicated that this effect would be "significant." These responses did not statistically vary by region or by the environmental media managed by the respondent's office, but in the aggregate provide corroborative evidence that regulators perceive there to be a connection between environmental regulatory stringency and private sector economic investment.

The third and final question in this series asked the senior managers about the relationship between other states' regulatory practices and their own state's regulatory behavior:

> Next, I'd like to know whether other states' environmental regulations affect the environmental regulations in your state. Thinking about the primary industry that your office regulates, do other states' regulatory actions have no effect, a modest effect, or a significant effect on the actions that your office takes regarding your primary industry?

As presented in Table 7.18, over 60% of the senior managers indicated that other states' regulatory actions have an effect on their own state's regulatory behavior, although only about 11% indicated that other states' actions have a significant effect. The responses do not statistically vary by region, but there are some notable differences across the environmental media managed by the respondent's office, as indicated by a chi-square test ($\chi^2 = 17.0, p = .01$) and a oneway ANOVA test ($F = 4.5, p = .004$). According to the cross tabulations (not reported), respondents in offices addressing air pollution were much more likely than their counterparts in water and land pollution offices to say that regulatory actions in other states influences their own agency's actions. This makes sense. Air pollution, more so than water or land pollution, typically transcends political boundaries, so it is not terribly surprising that regulators are familiar with other states' efforts to manage this environmental problem.

Examining the relationships among the responses to these three questions is also useful for understanding how interstate economic competition affects state environmental regulatory practices. As noted above, the respondents' reply to the question about the main source of economic competition for the primary industry their office regulates serves as a measure of the degree of importance they give to interstate economic competition, at least relative to intrastate and international competition. Using this measure, we can test for a statistical association between responses to this question and responses to the question about whether reducing environmental standards would improve industry competitiveness.

The key question here is whether there is a systematic difference in perceptions about the importance of relaxing standards and the main perceived source of competition. If perceptions of interstate economic competition are related to environmental regulatory practices and are important to state environmental decision-making, we should observe evidence that respondents citing the importance of interstate economic competition as the major source of

competition for firms in the industry they regulate are as, if not more, likely to think that relaxing standards would improve these firms' competitiveness. Is this what we find? Again, because the competition response is ordinal, I use chi-square and oneway ANOVA tests to measure the association, rather than a correlation analysis. Each test suggests that there is a non-random association between the senior managers' responses to these questions, although the oneway ANOVA test of differences across the means is statistically significant only at the $p = 0.10$ level. The cross-tabulations are presented in Table 7.19. Respondents believing that the most intense economic competition for firms in their state comes from firms in other states, were more slightly likely to respond that relaxing standards would improve industry competitiveness – 65% compared to 54% and 60%, respectively, for respondents indicating that the most intense competition came from other firms in the state or from firms in other countries.

Another important relationship to examine is the statistical association between the regulators' responses to the source of competition question and the degree of influence of other states' regulatory actions on the respondent's own state. In particular, if interstate economic competition leads states to modify their regulatory behavior, we should expect to find that respondents indicating that firms in other states are the most intense source of competition, are as, if not more likely, to believe that their own state's environmental standards are affected by the other state' environmental regulations. As is presented in the bottom half of Table 7.19, the evidence does not support this conclusion. Both the chi-square test and oneway ANOVA test fail to show any statistically different relationships from what we would see by chance, but the data themselves are not inconsistent with the hypothesized relationship. The regulators pointing to competition with firms in other states as the most intense, were more likely than all respondents on average to say that others states' regulatory actions have "a significant effect" on their own states' environmental standards.

Regression analysis enables a more detailed examination. I consider whether perceptions about interstate economic competition help predict perceptions about the efficacy of relaxing standards on industry competitiveness and perceptions of the effect of other states' regulatory actions on the regulators' own states environmental standards. For this analysis, I recoded

my measure of respondents' perceptions of interstate economic competition into a simple indicator variable. This variable is coded 1 if the respondents answered that the most intense economic competition comes from firms in other states, and 0 otherwise. In the regression models, I also control for the individual's personal attributes, region of the country, and the environmental media managed by the respondent's office. Because both of the dependent variables are ordinal, I again estimate ordered logit models.

The results from these estimations, presented in Table 7.20, provide evidence supporting the existence of regulatory competition in state environmental regulation. In terms of the variable of primary interest, the importance respondents give to interstate competition is a strong predictor of their perceptions about the efficacy of relaxing environmental standards on industry competitiveness and their perceptions of whether other states' regulatory actions influence their own state's.[29] In the models, the coefficients of .664 and .497 suggest that there is a substantial difference between respondents that believe the most important source of competition for firms are firms in other states. In the case of relaxing standards, for a one standard deviation increase in perceptions on interstate competition, the odds of thinking that easing standards would improve industry competitiveness increase by a factor of 1.35. In terms of the second model, for a one standard deviation increase in beliefs about the strength of interstate competition, the odds of perceiving that other states' regulatory actions influences one's own state's actions increases by 1.25. With respect to the other explanatory variables in the model, not many provide much predictive value, and overall the models perform poorly in terms of explaining the overall variation.

7.4 Mechanisms of Regulatory Competition

The results of the SEMS, when coupled with the empirical analyses of state regulatory competition presented in previous chapters, provides robust evidence that interstate economic competition influences state environmental regulatory behavior. An additional advantage of survey analysis, is that helps elucidate the mechanisms of state responsiveness. I

[29]In models not reported, I also examined the effect of perception about interstate competition on the role that concerns over potential impacts to industry have played in agency actions. In general, part perceptions about interstate economic competition did not have much explanatory power.

included several questions in the SEMS for this purpose.

Following this series of questions, I also asked the respondents to indicate from what sources they learn about other states' regulatory practices. This is an important question for understanding the mechanisms of regulatory competition. To get at this issue, I included the following question in the SEMS:

> One might obtain information about other states' environmental standards, permitting requirements, approaches to enforcement, and other environmental policies from a number of sources. How would characterize the following sources in terms of where you obtain this type of information?

I asked the respondents to characterize whether the following were "not an information source," "a minor information source," or "a major information source": research by your agency, other agencies in your state, company representatives (i.e., permittees, regulated entities), EPA headquarters, EPA regional office, industry trade associations, professional membership organizations, and environmental advocacy groups. Table 7.21 shows the responses to this question.

According to the senior managers, the main sources of information about other states' regulatory practices was research conducted by the agency itself and information provided by the EPA regional office. About 65% of the respondents indicated that research performed by their own agency was "a major source" of information, while 49% indicated that the same for the EPA regional office. Industry-oriented information sources such as industry trade associations and company representatives and other agencies in the state were not identified by many respondents as major sources of information about other states' regulation. The fact that neither of these were major sources of information does undermine somewhat the mechanisms I identified in Chapter 2 as perhaps most likely to explain how regulatory competition might work. That said, I am hesitant to infer too much from the responses to a single survey question.[30]

[30]In retrospect, the response category "other agencies in your state," is too vague. This response was meant to pick up information garnered from elsewhere in the state, but should have been disaggregated to agencies, the governor's office, and the state legislature.

To gain some additional leverage, I included a more direct question about the degree of influence that various individuals and organizations have on state environmental standard-setting and enforcement. The literature on the political control of the bureaucracy suggests that multiple principals may simultaneously influence agency behavior (Whitford, 2005; Hammond and Knott, 1996; Wood and Waterman, 1994; Moe, 1985), so I considered the possibility that a large number of institutions and individuals could play an important role. A couple of studies have used surveys to examine the perceived influences of bureaucrats (Waterman, et al. 1998, 2004; Furlong, 1998), and I use a similar question to one used by Waterman, et al. (1998). Specifically, I asked:

> The following two questions deal with the level of influence different institutions and individuals exert over your agency. On a scale from zero to four, where 0 is no influence and 4 is a great deal of influence, how much influence do the following institutions and individuals have over how your agency sets environmental standards [enforce environmental regulations]?

I present the senior managers' responses in Table 7.22 for standard-setting and Table 7.23 for enforcement, with the individuals and institutions ranked according to their mean level of influence. Considering first agency officials' perceived influences in the area of standard-setting, the results are pretty clear – they view state legislatures ($\mu = 3.43$) and governors ($\mu = 3.05$) as having the most influence, followed in order by permittees/regulated entities ($\mu = 2.60$), business groups ($\mu = 2.60$), and state courts ($\mu = 2.58$). These results provide some evidence that state regulators are responding to the preferences of state elected officials and business-oriented interests. Federal level institutions and individuals comprised the next tier of influences, including federal courts ($\mu = 2.36$), the regional EPA Administrator ($\mu = 2.29$), the federal EPA Administrator ($\mu = 2.22$), and Congress ($\mu = 2.20$). Although these institutions and individuals are less influential than the state-level and business-interests, they are suggestive that the federal government does have some affect on state level regulatory practices. Finally, the second half of the rankings of influences suggest only a minor degree of influence for environmental groups, public opinion, agricultural groups, state economic development agencies, the President, the media, and local government officials.

The results shown in Table 7.23 regarding perceived influences in the area of regulatory enforcement suggest a similar picture. Again, the principals with the most significant level of influence according to the senior managers are state-level – state legislatures ($\mu = 2.61$), governors ($\mu = 2.53$), and state courts ($\mu = 2.42$). The agency officials perceived a combination of federal and business-oriented entities in the next grouping, as well as environmental groups. The least influential groups of individuals and institutions consist of the media, Congress, state economic development agencies, mayors, county commissioners, and, last, the President.

In sum, the responses to these questions provides at least some modest support for the notion that state regulators are influenced by both political principals – particularly, state-level individuals and institutions – and business-oriented interests. Federal level principals also seem to have some influence.

7.5 Conclusion

The purpose of the SEMS was twofold. First, the survey aimed to gain a better understanding of the perceptions of the state regulators responsible for carrying out state environmental policy, in an effort to test predictions of regulatory competition and race to the bottom theory and to verify the validity of some of the empirical findings discovered in previous chapters. Second, the SEMS helps to elucidate some the mechanisms of regulatory competition. In particular, the aim was to gain some insight as to why state regulators might engage in the type of regulatory competition suggested by the race to the bottom argument.

The responses to the SEMS were instructive. State regulators clearly attach some importance to environmental regulation (and, particularly, permitting and state flexibility) in industry investment decisions, although they think it is less important than other factors such as market proximity and labor costs. More importantly, concerns about possible impacts to industry have played a role in environmental regulatory decision-making, leading at times to relaxations of standards, changes to permit grating decisions, modifications to discharge limits, and, to a lesser extent, changes in enforcement behavior. In other words, concerns about environmental regulatory burdens affects state regulatory behavior, as the

regulatory competition argument would predict.

The SEMS also provides some new evidence about the influences of other states. The empirical analyses reported in Chapter 5 and Chapter 6 were designed to detect behavioral evidence of state responsiveness to economic competitor states. The SEMS provides evidence from the regulators themselves to support the findings of interdependence in state regulatory decision-making. This is one of most direct predictions of regulatory competition theory, and attitudinal evidence from the survey bolster the behavioral results. The results from the second half of the SEMS provide some (albeit modest, at times) evidence that state regulators are both familiar with other states' regulatory practices, and that other states regulatory practices lead to changes in their own regulatory decisions.

Last, the final set of questions in the SEMS provide some indication of the decision-making environment within states, as it relates to the relationship between environmental regulation and economic development, and the importance of interstate economic competition to state regulatory practices. The responses from the regulators indicate that there are multiple principals attempting to share information and influence regulatory decision-making. The key result here is that the most influence seems to be coming from state-level elected officials – both governors and state legislators – and business groups and regulated entities. While this lends some support to the theories I proposed to explain regulatory competition in Chapter 2, to fully understand the mechanisms at work at the state-level would require qualitative analysis, particularly detailed interviews with state regulators.

Appendix A: Variable Descriptions and Summary Statistics

Variable	Description	Mean	Stan. Dev.
Education	1 = less than high school. 2 = high school degree 3 = some college/2-yr college degree 4 = B.A. college degree 5 = B.S. college degree 6 = Advanced degree	5.46	.713
Income	1 = less than $30,000 2 = $30,000 to $39,999 3 = $40,000 to $49,999 : 9 = more than $100,000	7.28	1.91
Age	Continuous measure	49.6	6.87
Position tenure	Number of years in current position	8.97	7.31
Position tenure	Number of years at agency	19.1	8.52
Democrat	1 = Democrat 0 = Independent, other party, or no preference -1 = Republican	.124	.696
Political ideology	1 = Extremely conservative 2 = Conservative 3 = Slightly conservative 4 = Moderate, middle of the road 5 = Slightly liberal 6 = Liberal 7 = Extremely liberal	4.23	1.38
Environmental ideology	1 = Jobs, standard of living more important than environment : 7 = Protect environment, even if it costs jobs, standard of living	4.74	.993
Northeast	1 = BEA New England and Mideast 0 = otherwise	.231	.410
Midwest	1 = BEA Great Lakes and Plains 0 = otherwise	.221	.415
South	1 = BEA Southeast and Southwest 0 = otherwise	.337	.473
West	1 = BEA Rocky Mountain and Far West 0 = otherwise	.197	.398
Air	1 = Air pollution control-related office 0 = otherwise	.221	.415
Water	1 = Water pollution control-related office 0 = otherwise	.313	.464
Land and waste	1 = Land/Waste pollution control-related office 0 = otherwise	.311	.463
Other	1 = Other offices 0 = otherwise	.155	.362

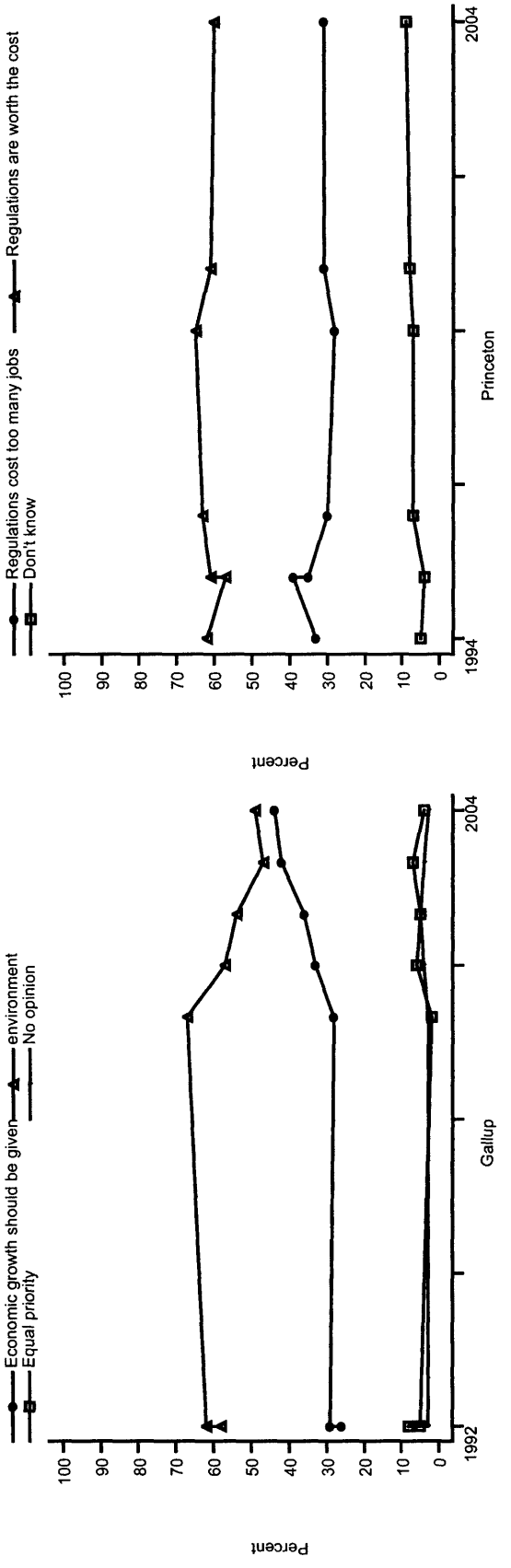

Figure 4.1: Public Opinion on Jobs v. Environment – Gallup and Princeton Questions

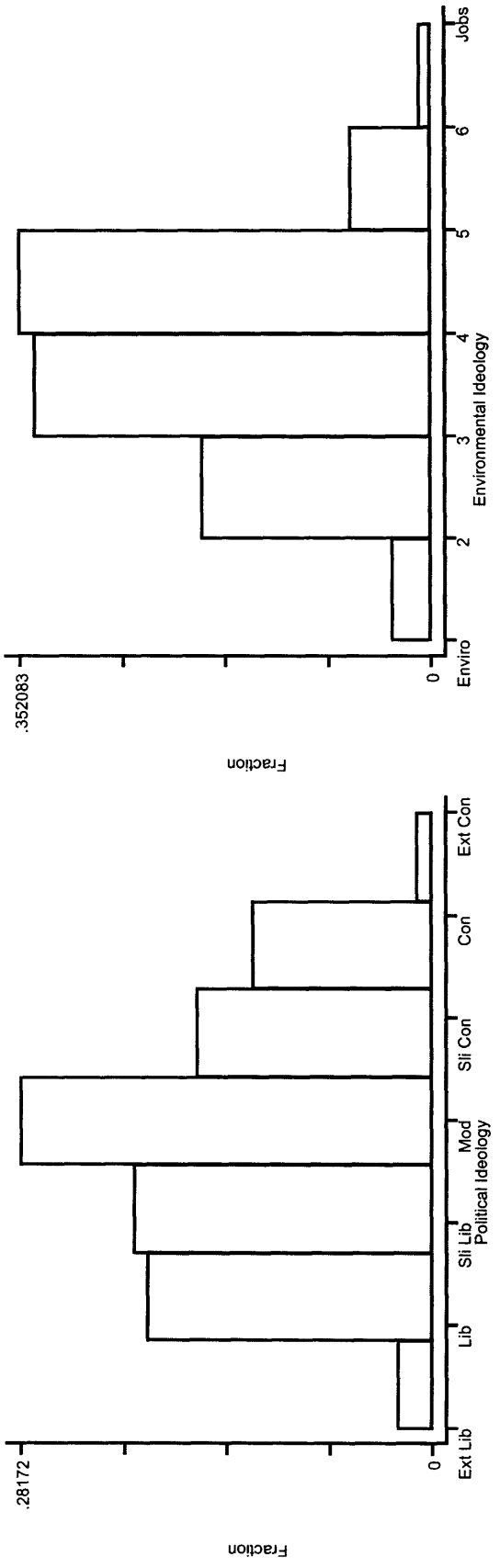

Figure 4.2: Respondents' Political and Environmental Ideology

Table 7.1 Public Opinion on Jobs v. Environment, 1996-2000					
Response	Position	1996	1998	2000	1996-2000
1	Protect environment, even if it costs jobs, standard of living	198 (11.6%)	242 (18.9%)	172 (17.1%)	612 (15.3%)
2		231 (13.5%)	203 (15.9%)	149 (14.8%)	583 (14.6%)
3		292 (17.1%)	184 (14.4%)	159 (15.8%)	635 (15.9%)
4		326 (19.1%)	229 (17.9%)	167 (16.6%)	722 (18.1%)
5		164 (9.5%)	116 (9.1%)	76 (7.6%)	356 (8.9%)
6		97 (5.7%)	59 (4.6%)	48 (4.8%)	204 (5.1%)
7	Jobs, standard of living more important than environment	64 (3.7%)	40 (3.1%)	36 (3.6%)	140 (3.5%)
9	Don't know, haven't thought much about it	339 (19.8%)	207 (16.2%)	197 (19.6%)	743 (18.6%)
Total		**1711 (100%)**	**1280 (100%)**	**1004 (100%)**	**3995 (100%)**
Mean		**3.42**	**3.10**	**3.14**	**3.25**

Source: American National Election Study, Cumulative File, 1948-2002.

Note: Response to question: "Generally speaking, some people think we need much tougher government regulations on business in order to protect the environment. (Suppose these people are at one end of the scale, at point 1.) Other people think that current regulations to protect the environment are already too much of a burden on business. (Suppose these people are at the other end of the scale, at point 7.) And, of course, some other people have opinions somewhere in between, at points 2, 3, 4, 5, and 6. Where would you place yourself on this scale?"

Table 7.2 SEMS Response Rate, by State			
State	Respondents	Potential Respondents	Response Rate (%)
Alaska	9	20	45.0
Alabama	6	22	27.3
Arkansas	13	40	32.5
Arizona	18	46	39.1
California	19	57	33.3
Colorado	7	31	22.6
Connecticut	2	13	15.4
Delaware	8	30	26.7
Florida	14	26	53.8
Georgia	11	43	25.6
Hawaii	7	14	50.0
Iowa	11	31	35.5
Idaho	5	22	22.7
Illinois	10	35	28.6
Indiana	7	42	16.7
Kansas	10	33	30.3
Kentucky	9	50	18.0
Louisiana	4	13	30.8
Massachusetts	8	13	61.5
Maryland	8	36	22.2
Maine	18	51	35.3
Michigan	15	40	37.5
Minnesota	11	36	30.6
Missouri	6	40	15.0
Mississippi	11	38	28.9
Montana	14	23	60.9
Nebraska	6	17	35.3
New Hampshire	10	24	41.7
New Jersey	17	50	34.0
New Mexico	4	19	21.1
Nevada	8	23	34.8
New York	2	21	9.50
North Carolina	17	36	47.2
North Dakota	4	23	17.4
Ohio	16	39	41.0
Oklahoma	10	39	25.6
Oregon	6	17	35.3
Pennsylvania	9	40	22.5
Rhode Island	5	15	33.3
South Carolina	17	58	29.3
South Dakota	3	14	21.4
Tennessee	4	14	28.6
Texas	10	37	27.0
Utah	21	42	50.0
Vermont	18	33	54.5
Virginia	10	31	32.3
Washington	9	25	36.0
Wisconsin	11	27	40.7
West Virginia	10	35	28.6
Wyoming	9	15	60.0
Total	**498**	**1459**	**34.1**

Table 7.3 Respondents Division/Office, By Media			
Media	Frequency	Percent	Cumulative Percent
Air	110	22.1	22.1
Water	156	31.3	53.4
Land and Waste	155	31.1	84.5
Other	77	15.5	100.0
Total	**498**	**100.0**	

Table 7.4 Main Regulatory Tools			
Response	Most frequent	2nd most frequent	3rd most frequent
Setting and/or reviewing standards	55 (11.2%)	74 (16.0%)	73 (16.3%)
Writing and/or reviewing permits	185 (37.7%)	83 (17.9%)	33 (8.0%)
Compliance monitoring	110 (22.4%)	125 (26.9%)	52 (11.6%)
Compliance assistance	31 (6.3%)	77 (16.6%)	108 (24.0%)
Enforcement	26 (5.3%)	60 (12.9%)	127 (28.3%)
Remediation/reclamation	45 (9.2%)	31 (6.7%)	34 (7.6%)
Other	39 (7.9%)	14 (3.0%)	19 (4.2%)
Total	**491 (100%)**	**464 (100%)**	**449 (100%)**

Note: Response to question: "What are the main regulatory actions your office takes in support of its mission? Please rank up to 3."

Table 7.5 Respondent Demographics					
Gender	Male 370 (80.3%)			Female 91 (19.7%)	
Experience (mean)	Years in position 8.78			Years in agency 19.0	
Education	H.S. 3 (0.64%)	Associate 8 (1.7%)	B.A. 20 (4.3%)	B.S. 176 (37.5%)	Advanced 262 (55.9%)
Household income	< 40K 4 (0.96%)	40K to 60K 40 (9.5%)	60K to 80K 92 (21.9%)	80K to 100K 97 (23.0%)	> 100K 188 (44.7%)
Political party	Rep. 85 (19.5%)	Dem. 160 (36.8%)	Ind. 134 (30.8%)	Other 5 (1.2%)	None 51 (11.7%)

Table 7.6 Respondents Educational Background, by Discipline

Discipline	Frequency	Percent	Cumulative Percent
Biology	65	13.9	13.9
Chemistry	7	1.5	15.4
Ecology	12	2.6	18.0
Other physical science	57	12.2	30.1
Chemical engineering	32	6.8	37.0
Environmental engineering	83	17.7	54.7
Other engineering	51	10.9	65.6
Social sciences	13	2.8	68.4
Business/Finance	22	4.7	73.1
Law	20	4.3	77.4
Humanities	1	0.2	77.6
Other	105	22.4	100.0
Total	**498**		

Note: Response to question: "In which field was your most advanced degree awarded?"

Table 7.7 Factors Important in Facility Location Decisions

Rank	Factor	Mean	St. Dev.	Responses
1	Quality and proximity of transportation facilities	3.59	.561	472
2	Labor costs and quality (e.g., unionization laws, skill)	3.57	.608	469
3	Proximity to customers/markets	3.46	.672	473
4	Tax incentives and/or subsidies	3.41	.694	468
5	Proximity to natural resources/raw materials	3.27	.770	472
6	Environmental regulations	2.91	.720	474

Response to question: "Companies consider a number of factors when making a decision about where to locate a new facility. Suppose a company in an industry regulated by your agency was deciding where in the United States to locate a new facility. How important do you believe the company would consider the following factors?"

Response categories: "not a factor" (1), "not too important a factor" (2),"a fairly important factor" (3), and "a very important factor" (4).

Table 7.8 Environmental Factors Important in Facility Location Decisions

Rank	Factor	Mean	St. Dev.	Responses
1	State officials' flexibility and willingness to help industry	3.06	.652	478
2	Time/expense in obtaining permits	3.06	.633	475
3	Stringency of written environmental standards	2.91	.694	473
4	Pollution control incentives	2.73	.733	468
5	Stringency of environmental enforcement	2.57	.776	472

Response to question: "Again, suppose a company in an industry regulated by your agency was deciding where in the United States to locate a new facility. How important do you believe this company would consider the following factors?"

Response categories: "not a factor" (1), "not too important a factor" (2),"a fairly important factor" (3), and "a very important factor" (4).

Table 7.9 Determinants of Perceptions about the Importance of Environmental Regulation to Industrial Siting Decisions

	Regulation (1)	Regulation (Primary) (2)	Written Standards (3)	Enforcement (4)	4-Item Scale (5)
Personal attributes					
Education	-0.236	-0.310*	-0.121	-0.127	-0.242
	(0.135)	(0.141)	(0.139)	(0.135)	(0.128)
Income	0.027	0.063	0.001	0.002	0.049
	(0.053)	(0.055)	(0.054)	(0.052)	(0.051)
Age	0.031	0.001	-0.001	0.014	0.009
	(0.019)	(0.018)	(0.019)	(0.019)	(0.017)
Position tenure	-0.009	0.007	0.022	0.008	0.007
	(0.015)	(0.016)	(0.016)	(0.016)	(0.015)
Agency tenure	-0.021	-0.017	-0.027	-0.034*	-0.021
	(0.016)	(0.016)	(0.016)	(0.016)	(0.015)
Democrat	0.221	0.074	0.076	-0.012	0.049
	(0.149)	(0.151)	(0.154)	(0.151)	(0.139)
Political ideology	-0.195*	-0.137	-0.282**	-0.171*	-0.226**
	(0.081)	(0.082)	(0.085)	(0.083)	(0.077)
Environmental ideology	0.155	-0.003	0.137	0.142	0.144
	(0.109)	(0.108)	(0.111)	(0.110)	(0.104)
Region					
Northeast	-0.102	-0.438	-0.244	-0.201	-0.273
	(0.278)	(0.277)	(0.288)	(0.285)	(0.267)
Midwest	-0.091	-0.084	0.129	0.014	-0.039
	(0.259)	(0.264)	(0.268)	(0.263)	(0.244)
West	0.144	0.116	0.452	0.540	0.469
	(0.283)	(0.292)	(0.292)	(0.277)	(0.274)
Environmental media managed					
Air	-0.473	-0.081	0.201	-0.312	-0.301
	(0.316)	(0.318)	(0.321)	(0.312)	(0.294)
Water	0.165	0.613*	0.752*	0.392	0.433
	(0.302)	(0.307)	(0.307)	(0.296)	(0.277)
Land and waste	-0.332	-0.018	0.336	-0.005	-0.058
	(0.299)	(0.300)	(0.304)	(0.293)	(0.277)
n	390	375	388	388	368
Log-likelihood	-408.28	-415.84	-382.96	-428.33	-786.75
McKelvey and Zavoina R^2	.06	.07	.08	.07	.08
LR test	21.3	22.1	27.7	26.6	30.2
(Prob > χ^2)	(0.09)	(.08)	(.02)	(.02)	(.01)

Table 7.10 Importance of Concerns About Impacts to Industry on Agency Regulatory Practices

Rank	Factor	Role Mean (St. Dev.)	Frequency* Mean (St. Dev.)	Responses
1	Discouraging or opposing adoption of a more stringent environmental standard	2.65 (.823)	1.87 (.676)	448
2	Granting or advocating granting of an environmental permit	2.41 (.874)	1.82 (.734)	435
3	Adopting or advocating adopting of a less stringent environmental standard	2.38 (.893)	1.72 (.690)	447
4	Allowing or advocating allowing larger emissions or discharges	2.08 (.874)	1.50 (.650)	424
5	Levying or advocating levying a smaller or lighter civil or criminal penalty	1.98 (.805)	1.59 (.654)	428
6	Dropping or advocating dropping of an environmental enforcement action	1.77 (.770)	1.37 (.557)	435
7	Delaying or advocating delay of a facility inspection	1.38 (.612)	1.21 (.457)	433

Response to question: "How important a role has concern over potential impacts on industry played in your agency's actions in the following areas?"

Response categories in column 3: "no role whatsoever"(1), "not too important a role" (2),"a fairly important role" (3), and "a very important role" (4).

Response categories in column 4: "rarely"(1), "from time-to-time" (2),"frequently" (3). * Does not include "not applicable" responses (i.e., cases where response to initial question was "no role whatsoever."

Table 7.11 Respondents Knowledge About Other States' Enforcement Efforts			
Response	Frequency	Valid Percent	Cumulative Percent
Much stronger than most	83	16.9	16.9
A little stronger than most	132	26.9	43.8
About the same as most	154	31.4	75.2
A little weaker than most	54	11.0	86.2
Much weaker than most	12	2.4	88.6
Not sure	56	11.4	100.0
Total	**491**	**100.0**	

Note: Response to question: "Generally, states differ in their environmental enforcement (e.g., permitting requirements, frequency of inspections, responses to violations, etc.). Where would you say your state ranks in environmental enforcement compared to other states, or are you not sure?"

Table 7.12 Perception of Other States' Enforcement Efforts, by Region

	How does your state rank in environmental enforcement compared to other states?						
Region	Much stronger	A little stronger	About the same	A little weaker	Much weaker	Not sure	Total
Northeast	29 (27.9%)	33 (31.7%)	24 (23.1%)	4 (3.8%)	2 (1.9%)	12 (11.5%)	104 (100.0%)
South	27 (16.5%)	42 (25.6%)	53 (32.3%)	15 (9.1%)	6 (3.7%)	21 (12.8%)	164 (100.0%)
Midwest	9 (8.3%)	29 (26.6%)	40 (36.7%)	16 (14.7%)	0 (0.0%)	15 (13.8%)	109 (100.0%)
West	18 (18.4%)	27 (27.6%)	27 (27.6%)	16 (16.3%)	3 (3.1%)	7 (7.1%)	98 (100.0%)
Total	83 (17.5%)	131 (27.6%)	144 (30.3%)	51 (10.7%)	11 (2.3%)	55 (11.6%)	475 (100.0%)
	Pearson $\chi^2(15) = 32.4; p = 0.006$ Oneway ANOVA $F = 3.06; p = 0.028$						

Table 7.13 Perceptions of Stronger and Weaker Environmental Enforcement States

State	Stronger Enforcement	Weaker Enforcement
Alaska	0	29
Alabama	2	68
Arkansas	3	18
Arizona	3	8
California	242	0
Colorado	13	5
Connecticut	12	0
Delaware	2	3
District of Columbia	1	1
Florida	29	13
Georgia	0	19
Hawaii	3	5
Iowa	0	7
Idaho	1	23
Illinois	10	1
Indiana	0	10
Kansas	0	2
Kentucky	1	16
Louisiana	2	103
Massachusetts	62	2
Maryland	12	3
Maine	7	1
Michigan	15	17
Minnesota	28	3
Missouri	0	8
Mississippi	2	71
Montana	1	7
Nebraska	1	3
New Hampshire	3	1
New Jersey	73	4
New Mexico	2	11
Nevada	0	17
New York	74	0
North Carolina	7	5
North Dakota	1	11
Ohio	11	15
Oklahoma	0	13
Oregon	43	0
Pennsylvania	11	5
Rhode Island	0	1
South Carolina	1	8
South Dakota	0	14
Tennessee	1	13
Texas	6	58
Utah	1	13
Vermont	8	1
Virginia	4	3
Washington	42	1
Wisconsin	19	1
West Virginia	4	17
Wyoming	0	24
Not Sure	1086	1161

Table 7.14 Stringency of Environmental Enforcement of Competitor States				
Response	State 1	State 2	State 3	State 4
Much more stringent	29 (9.9%)	16 (5.7%)	13 (5.4%)	6 (3.4%)
A little more stringent	39 (13.3%)	36 (12.9%)	25 (10.4%))	28 (15.7%)
Of about the same stringency	90 (30.6%)	87 (31.2%)	72 (30.0%)	44 (24.7%)
A little less stringent	63 (21.4%)	69 (24.7%)	60 (25.0%)	51 (28.7%)
Much less stringent	31 (10.5%)	32 (11.5%)	33 (13.8%)	20 (11.2%)
Not sure	42 (14.3%)	39 (14.0%)	37 (15.4%)	29 (16.3%)
Total	**294 (100.0%)**	**279 (100.0%)**	**240 (100.0%)**	**179 (100.0%)**

Note: Initial question: "Again, thinking about the primary industry your office regulates, which three or four states does your state compete with most for companies and jobs in this industry?" Responses reported above are to follow-up question: "How do each of these states' environmental enforcement efforts compare to your own state's, are they much more stringent, a little more stringent, of about the same stringency, a little less stringent, or much less stringent, or are you not sure?"

Table 7.15 Location of States Identified by Respondents as Economic Competitors

Respondent's State	Contiguous Neighbor (%)	BEA Region (%)	Crone Region (%)
Alabama	90.9	90.9	100.0
Arizona	80.0	25.7	5.7
Arkansas	83.3	44.4	50.0
California	62.5	37.5	62.5
Colorado	57.1	50.0	28.6
Connecticut	0.0	0.0	25.0
Delaware	63.2	68.4	0.0
Florida	40.9	68.2	63.6
Georgia	91.3	100.0	100.0
Idaho	93.3	40.0	60.0
Illinois	85.7	57.1	33.3
Indiana	93.8	75.0	75.0
Iowa	87.5	62.5	18.8
Kansas	65.4	30.8	30.8
Kentucky	80.8	42.3	30.8
Louisiana	60.0	66.7	26.7
Maine	8.0	16.0	16.0
Maryland	91.7	50.0	41.7
Massachusetts	54.5	36.4	18.2
Michigan	52.8	66.7	55.6
Minnesota	69.4	55.6	13.9
Mississippi	80.6	91.7	75.0
Missouri	93.3	26.7	26.7
Montana	44.4	37.0	14.8
Nebraska	58.3	58.3	33.3
Nevada	76.5	41.2	41.2
New Hampshire	55.0	70.0	45.0
New Jersey	54.3	60.0	60.0
New Mexico	83.3	58.3	25.0
North Carolina	68.0	80.0	80.0
North Dakota	54.5	63.6	18.2
Ohio	70.8	50.0	50.0
Oklahoma	94.4	33.3	38.9
Oregon	83.3	66.7	83.3
Pennsylvania	88.9	70.4	59.3
Rhode Island	72.7	72.7	0.0
South Carolina	57.4	97.9	97.9
South Dakota	20.0	20.0	0.0
Tennessee	100.0	100.0	100.0
Texas	33.3	7.4	40.7
Utah	65.2	37.0	17.4
Vermont	80.0	65.0	45.0
Virginia	83.3	83.3	66.7
Washington	34.8	43.5	65.2
West Virginia	70.4	48.1	14.8
Wisconsin	56.3	43.8	6.3
Wyoming	56.3	56.3	6.3

Note: Values are percent of economic competitor states identified falling into one of these three categories. New York is excluded due to non-response.

Table 7.16 Source of Economic Competition			
Response	Frequency	Valid Percent	Cumulative Percent
Other firms within the state	147	31.0	31.0
Firms in other states	128	27.0	57.9
Firms in countries outside the United States	79	16.6	74.5
Not sure	121	25.5	100.0
Total	**471**	**100.0**	

Note: Response to question: "Thinking about the primary industry your office regulates, where does the most intense economic competition for firms in this industry come from: other firms within the state, firms in other states, firms in countries outside the United States, or are you not sure?"

Table 7.17 Effect of Relaxing Environmental Standards on Firm Competitiveness			
Response	Frequency	Valid Percent	Cumulative Percent
No effect	209	45.4	45.5
A modest effect	197	42.8	88.3
A significant effect	54	11.7	100.0
Total	**460**	**100.0**	

Note: Response to question: "Again, thinking about the primary industry your office regulates, how much of an effect would relaxing the environmental standards for companies in this industry have in improving their competitiveness compared to similar companies operating in other states?"

Table 7.18 Effect of Other States' Regulatory Actions			
Response	Frequency	Valid Percent	Cumulative Percent
No effect	177	37.7	37.7
A modest effect	239	51.0	88.7
A significant effect	53	11.3	100.0
Total	**469**	**100.0**	

Note: Response to question: "Next, I'd like to know whether other states' environmental regulations affect the environmental regulations in your state. Thinking about the primary industry that your office regulates, do other states' regulatory actions have no effect, a modest effect, or a significant effect on the actions that your office takes regarding your primary industry?"

Table 7.19 Perceptions of Source of Economic Competition and Importance of Standards

	How much of an effect would relaxing environmental standards have in improving industry competitiveness?			
Source of most intense economic competition	No effect	A modest effect	A significant effect	Total
Other firms within the state	67 (46.2%)	64 (44.1%)	14 (9.6%)	145 (100.0%)
Firms in other states	45 (35.4%)	60 (47.2%)	22 (17.3%)	127 (100.0%)
Firms in other countries	31 (39.7%)	43 (55.1%)	4 (5.1%)	78 (100.0%)
Not sure	63 (59.4%)	29 (27.4%)	14 (13.2%)	106 (100.0%)
Total	206 (45.2%)	196 (43.0%)	54 (11.8%)	456 (100.0%)
	Pearson $\chi^2(15) = 24.2; p = 0.000$ Oneway ANOVA: $F = 2.36$; $p = 0.096$			

	How much do other states' regulatory actions affect your state's environmental regulations?			
Source of most intense economic competition	No effect	A modest effect	A significant effect	Total
Other firms within the state	59 (40.7%)	74 (51.0%)	12 (8.3%)	145 (100.0%)
Firms in other states	39 (31.0%)	68 (54.0%)	19 (15.1%)	126 (100.0%)
Firms in other countries	25 (32.1%)	42 (53.8%)	11 (14.1%)	78 (100.0%)
Not sure	52 (46.4%)	50 (44.6%)	10 (8.9%)	112 (100.0%)
Total	175 (38.0%)	234 (50.8%)	52 (11.3%)	461 (100.0%)
	Pearson $\chi^2(6) = 9.85; p = 0.131$ Oneway ANOVA: $F = 0.46$; $p = 0.632$			

Table 7.20 The Impact of Perceptions of Interstate Economic Competition		
	Relaxing Standards Improve Industry Competitiveness	Other States' Regulatory Actions Influence State's Own
Interstate competition	0.664**	0.497*
	(0.229)	(0.233)
Personal attributes		
Education	-0.047	0.278
	(0.141)	(0.149)
Income	0.041	0.062
	(0.054)	(0.056)
Age	-0.013	-0.004
	(0.019)	(0.019)
Position tenure	0.010	-0.023
	(0.016)	(0.016)
Agency tenure	0.019	0.015
	(0.016)	(0.016)
Democrat	0.305*	-0.018
	(0.154)	(0.155)
Political ideology	0.003	0.149
	(0.083)	(0.085)
Environmental ideology	-0.124	-0.137
	(0.111)	(0.113)
Region		
Northeast	-0.177	0.064
	(0.288)	(0.293)
Midwest	-0.143	0.065
	(0.268)	(0.273)
West	-0.026	-0.210
	(0.290)	(0.294)
Environmental media managed		
Air	-0.132	0.796*
	(0.325)	(0.331)
Water	0.286	0.001
	(0.318)	(0.318)
Land and waste	-0.112	0.139
	(0.310)	(0.314)
n	376	377
Log-likelihood	-359.45	-351.16
McKelvey and Zavoina R^2	.05	.09
LR test	18.0	30.5
(Prob > χ^2)	(0.263)	(.01)

Table 7.21 Sources of Information on Other States Regulatory Practices

Source	Not an source	A minor source	A major source	Total
Research by your agency	44 (9.2%)	124 (26.1%)	308 (64.7%)	476 (100.0%)
EPA regional office	52 (11.1%)	186 (39.7%)	230 (49.2%)	468 (100.0%)
Professional membership organizations	104 (22.4%)	213 (45.9%)	147 (31.7%)	464 (100.0%)
Industry trade associations	97 (21.1%)	263 (57.2%)	100 (21.7%)	460 (100.0%)
EPA headquarters	119 (25.4%)	227 (48.5%)	122 (26.1%)	468 (100.0%)
Company representatives (i.e, permittees, regulated entities	92 (20.0%)	277 (60.1%)	92 (20.0%)	461 (100.0%)
Environmental advocacy groups	125 (26.9%)	279 (60.0%)	61 (13.1%)	465 (100.0%)
Other agencies in your state	179 (38.5%)	233 (50.0%)	53 (11.4%)	465 (100.0%)

Response to question: "One might obtain information about other states' environmental standards, permitting requirements, approaches to enforcement, and other environmental policies from a number of sources. How would characterize the following sources in terms of where you obtain this type of information?"

Response categories: "not an information source (1), "a minor information sources" (2), and "a major information source" (3).

Table 7.22 External Influence on State Environmental Standard-Setting

Rank	Individual/Institution	Level of Influence Mean (St. Dev.)	Responses
1	State Legislatures	3.43 (.898)	476
2	Governor	3.05 (1.06)	462
3	Permittees/regulated entities	2.60 (.924)	471
4	Business groups	2.58 (1.01)	470
5	State courts	2.46 (1.17)	467
6	Federal courts	2.36 (1.16)	474
7	Regional EPA Administrator	2.29 (1.25)	472
8	EPA Administrator	2.22 (1.22)	469
9	Congress	2.20 (1.30)	476
10	Environmental groups	2.12 (.925)	472
11	Public opinion	2.09 (1.29)	473
12	Agricultural groups	1.93 (.969)	468
13	State economic development agencies	1.55 (1.07)	469
14	President	1.41 (1.25)	
15	Media	1.27 (.976)	473
16	Mayors	1.23 (.948)	469
17	County commissioners	1.20 (1.02)	464

Response to question: "The following question deals with the level of influence different institutions exert over your agency. On a scale of zero to four, where 0 is no influence and 4 is a great deal of influence, how much influence do the following institutions and individuals have over how your agency sets environmental standards?"

Table 7.23 External Influence on State Environmental Enforcement

Rank	Individual/Institution	Level of Influence Mean (St. Dev.)	Responses
1	State Legislatures	2.61 (1.19)	463
2	Governor	2.53 (1.29)	454
3	State courts	2.42 (1.27)	463
4	Regional EPA Administrator	2.17 (1.14)	468
5	Federal courts	1.98 (1.31)	462
6	Permittees/regulated entities	1.87 (1.06)	458
7	Business groups	1.76 (1.13)	460
8	Environmental groups	1.67 (1.01)	463
9	EPA Administrator	1.58 (1.25)	465
10	Public opinion	1.53 (.935)	459
11	Agricultural groups	1.43 (1.24)	461
12	Media	1.20 (.951)	461
13	Congress	1.02 (1.17)	463
14	State economic development agencies	.976 (1.00)	462
15	Mayors	.921 (.916)	458
16	County commissioners	.881 (.922)	455
17	President	.689 (.979)	464

Response to question: "The following question deals with the level of influence different institutions exert over your agency. On a scale of zero to four, where 0 is no influence and 4 is a great deal of influence, how much influence do the following institutions and individuals have over how your agency enforces environmental standards?"

Chapter 8. Conclusion

Introduction

Social scientists have long theorized about the potential effects of interstate economic competition on the provision of environmental protection. Although the theoretical literature is mature in this area, the empirical literature has lagged far behind in testing the central predictions of theoretical models. In particular, scholars have not done an adequate job detecting the strategic behavior predicted by regulatory competition generally, and the race to the bottom argument specifically.

This is an important omission. One of the key questions confronting contemporary U.S. environmental policy regards the appropriate assignment of regulatory authority among the different levels of government. In the early 1970s, the federal government gave itself unprecedented authority to manage a wide range of environmental problems, including air and water pollution, hazardous waste management, drinking water quality, and endangered species protection. Although states maintained considerable discretion under the regulatory federalism model established by Congress to address these environmental challenges, there persistently have been calls by political elites and professionals alike for devolution of regulatory authority to states (and increasingly to local governments).

At the center of the disagreement between advocates and skeptics of decentralization is the question of how state governments will balance the dual – and often conflicting – goals of economic development and environmental protection. In particular, the debate centers on the issue of how states will respond to competition from other states for economic investment, and whether concerns about losing investment to other states will result in them weakening their environmental regulatory effort. The theoretical literature makes a strong case that, faced with interstate economic competition, states have incentives to reduce the regulatory burdens they place on potential (and existing) mobile capital. In this context, if states behave strategically, there is a concern that states will engage in regulatory competition in a fashion that will lead to a nationwide lowering of standards down to the level of the least stringent state. In this dissertation, I have analyzed several types of behavioral and

attitudinal evidence to see if this type of environmental regulatory race to the bottom has occurred.

I have addressed several key hypotheses derived from the environmental race to the bottom argument. First, I have examined (Chapter 4) whether there has been a pattern of convergence in state-level environmental regulatory effort. An implication of the race to the bottom argument is that, over time, state environmental regulatory effort will coalesce to the level of the state putting forth the least environmental regulatory effort. Through graphical and statistical analysis, I find some modest indication of convergence.

Second, I examined whether state environmental regulatory behavior responds to the environmental regulatory behavior of competitor states (Chapter 5). Stated differently, I asked the question: is there strategic interaction in states' regulatory practices. This is, perhaps, the central prediction of the regulatory competition behavior inherent to the race to the bottom argument. If states do not act strategically by responding to the regulatory behavior of economic competitor states, one can only conclude that there is no race to the bottom. To test the strategic interaction hypothesis, I estimated a series of statistical models. Controlling for various political and economic factors that too should effect a state's regulatory enforcement effort, I found consistent evidence of state responsiveness, which is supportive of the strategic interaction hypothesis. This finding was robust across several definitions of economic competitor states (and weighting schemes), and using data on state enforcement of the three primary, federal pollution control programs: the Clean Air Act, the Clean Water Act, and the Resource Conservation and Recovery Act.

The presence of strategic interaction alone, however, is not sufficient for evaluating the race to the bottom argument. The argument suggests a specific pattern of strategic interaction: states should respond to competitor states' regulatory behavior, only when this behavior puts them at a disadvantage for attracting new economic investment. To investigate this hypothesis, I estimated a couple of revised statistical models to examine state behavior in two different cases in which they should plausibly be at comparative disadvantage for attracting economic investment – that is, cases in which they would be more likely to use their environmental regulation as a competitive instrument. These asymmetric effects

models do not provide strong support for the race to the bottom argument. While I do find evidence that states respond to the regulatory enforcement effort of competitor states in cases where their own enforcement effort puts them at a disadvantage for attracting economic investment, I also detect a similar level of responsiveness in cases when a state's enforcement efforts already puts them in "better" position than states with which they compete for economic investment. This latter pattern is suggestive of a regulatory race to the top, not a regulatory race to the bottom.

In a final set of strategic interaction models, I pushed the race to the bottom theory further by hypothesizing about the relative susceptibility of states to use their regulation as competitive instruments when confronted with economic competition from other states. In particular, I argued that states were more likely to respond to competitor states, when their economies are small, highly-dependent on pollution-intensive industries, and contain high levels of geographically-mobile industries (Chapter 6). In other words, I suggested that states may vary in their underlying propensity to engage in regulatory competition, depending on the size and structure of their state economy. Stated simply, states may differ in important ways that matter for whether they engage in race to the bottom-type behavior. The evidence I gathered from testing this hypothesis was mixed. While I did find that states with smaller economies are more likely to respond to the regulatory behavior of their economic competitors, I did not find that the relative pollution-intensity or footloose nature of the state's manufacturing sector help predict the degree of state responsiveness to economic competitor states.

To summarize this behavioral evidence, I did not find overwhelming support for the race to the bottom argument in state environmental regulatory enforcement behavior. This is not to say that no states respond to interstate economic competition by weakening their environmental regulatory practices. In fact, I find evidence supportive of this conclusion, particularly for states with smaller economies. However, this behavior does not characterize state environmental regulation nationwide, which is good news for proponents of decentralization of regulatory authority from the federal government to state governments.

To supplement this behavioral evidence, as well as to investigate the mechanisms of

regulatory competition at the level of state decision-making, I conducted the State Environmental Managers Survey. This large-scale survey enabled me to address a number of attitudinal predictions of the environmental race to the bottom argument. In particular, if states are engaged in regulatory competition consistent with the race to the bottom argument, I argue that we should observe some evidence that state government officials perceive that economic investment responds to the stringency (or lack thereof) of environmental regulation (Chapter 7). In addition, we should find evidence that, at times, state environmental agencies modify their regulatory practices in response to concerns that state environmental regulation has an effect on private sector investment decisions. Finally, strategic behavior vis-à-vis economic competitor states assumes that state regulators have knowledge about the regulatory policies and practices of other states.

The evidence supporting these hypotheses was strong. Responses to the SEMS indicate that state regulators believe that environmental regulation (and, particularly, permitting and state flexibility) is a factor in industry decisions about where to locate a facility, albeit they believe it is less of a factor than transportation quality, market proximity, and labor costs. The senior managers I surveyed also revealed that concerns about possible impacts to industry have played a role in environmental regulatory decision-making. In other words, concerns about the effect of regulatory burdens on industry investment decisions, does seem to influence state regulatory behavior. This is an important finding. Even though regulators think industry pays less attention to environmental regulation than other factors when making decisions about where to make capital investments, they still think such concerns influence state policymaking. As Oates (2001) has noted: "Irrespective of the actual facts on the location decisions in polluting industries, whether officials use environmental regulations for competitive purposes depends largely on perceptions. If policymakers think that these regulations matter, then they may well craft environmental legislation in the light of their objectives for economic development." Stated simply, perceptions matter.

The SEMS also provides some new evidence about the influences of other states. The empirical analyses reported in Chapter 5 and Chapter 6 were designed to detect behavioral evidence of state responsiveness to economic competitor states. The SEMS provides evidence

from the regulators themselves to support the findings of interdependence in state regulatory decision-making. This is one of most direct predictions of regulatory competition theory, and attitudinal evidence from the survey bolsters the behavioral results. The results from the second half of the SEMS provide some evidence that state regulators are both familiar with other states' regulatory practices, and that other states regulatory practices lead to changes in their own regulatory decisions.

The analyses in my dissertation have, by no means, resolved all of the questions surrounding the race to the bottom argument, as it applies to the environmental regulatory context. There are several avenues for future research, some of which can be answered with the data compiled as part of this project.

First, more work is necessary to identify the characteristics of states that make them more (or less) susceptible to use their environmental regulation as a competitive instrument when confronted with interstate economic competition. In this project, I considered several different attributes of state economic structure, but these attributes are not exhaustive of the reasons states may have different underlying propensities to engage in race to the bottom-type behavior. Other factors such as state political ideology, interest group structure, and electoral cycles could all influence the likelihood that a state turns to environmental regulation as a competitive instrument. While I control for these factors linearly, they may work interactively thus requiring different statistical models to test.

Second, I have only considered whether states utilize a single instrument – environmental enforcement. States, of course, have multiple instruments available to them to attract new (or retain existing) economic investment. One recent paper finds some evidence supportive of the notion that states utilize three interrelated policies in their efforts to attract economic investment – environmental regulation, taxation, and infrastructure investment (Fredriksson, et al. 2004). Further research in this direction is necessary to fully understand the ways states compete.

Third, the environmental race to the bottom argument also suggests implications for other forms of state regulatory behavior. In addition to responsiveness to economic competitor states, the argument implies a particular spatial pattern of regulatory behavior within states.

More specifically, the race to the bottom argument suggests that states have incentives to free ride on the environmental protection efforts of neighboring states. That is, to the extent that there are transborder pollution spillovers, states may shift their own environmental protection efforts to particular geographical locations in their states, since the environmental effects of activity in some other locations can be "exported" to their neighbors. A few scholars have studied this possibility by comparing environmental quality indicators in border areas of states (Sigman, 2005; Whitford and Helland, 2003), but what is needed is studies of government regulatory behavior in these border areas. The environmental enforcement data I compiled for this project comprise a promising dataset for a study of this kind.

Last, more research is needed to better understand the mechanisms of regulatory competition. In particular, not much is known about the decision-making processes occurring within state governments that leads them to respond strategically vis-à-vis other states. What is the impetus for this responsiveness? The SEMS provided some insight into this question, by identifying the sources of information about other states' regulatory practices and the principals that influence state environmental agencies, but fully understanding the decision-making processes within states requires more detailed, "micro" analysis. Qualitative case studies would be quite useful for disentangling the key players, the most important sources of influence, and the dynamics of competition regarding specific efforts to attract economic investment.

Each of these avenues for future research is important. The intuitive logic of the race to the bottom argument demands that the theory continue to be challenged. The evidence found in this project generally contradicts a simple race to the bottom explanation of state level environmental regulation. Nonetheless, scholars should continue to investigate the argument to test its empirical validity. Whether or not a race to the bottom dynamic exists, either across the country or on a smaller scale, should be of interest to a broad set of social science literatures, ranging from federalism to policy diffusion to state politics and policy to regulation. At stake, fundamentally, is understanding how states function in a federal system faced with multiple policy goals – in this case, economic development and environmental protection. These policy objectives remain salient on the state policy agendas,

which signifies the continuing importance of this research agenda.

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